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A TURNOUT ON THE MURREN ALPINE RAILWAY.—[See page 169.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, FEBRUARY 24, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE SHIP SUBSIDY BILL.

The day when the American merchant marine shall be restored to its former proud position in the deep-sea carrying trade of the world has been brought a step nearer by the passing of the Ship Subsidy Bill by the Senate. Although the measure, as amended, does not undertake to assist the merchant marine to the extent that its friends had hoped, it should prove of enormous assistance in lifting the shipbuilding industry from the slough of despond into which it has fallen. The fate of the bill is now in the hands of the House of Representatives, and if the generally-favorable attitude of the individual members be sustained, it should become a law by the close of the present session.

The history of the movement to resuscitate our shipbuilding and deep-sea carrying interests shows that there has been a gradual education of the public to the true meaning of the proposed subsidy, and to a realization of its absolute necessity, if we are to carry our own imports and exports in American bottoms—to say nothing of our sharing in the general deep-sea trade of the world. At the present time the United States is paying out between 200 and 300 million dollars annually to foreign shipping concerns, for carrying to and fro the foreign trade of this country. This immense revenue, logically and by right, should be earned by American ships. That it is diverted to foreign nations is due to the fact that because of the higher wages and the higher ideas of living and comfort that prevail in the United States, it is impossible either to build or to operate ocean-going ships as cheaply as they can be built and operated by foreign countries. Although the cost of ship construction is being gradually reduced, it still costs considerably more per ton to build a steamship in our own than it does in European shipyards; and the more generous wages paid to officers and crews, and the better class of fare provided, increase the cost of operation of ships, if manned by Americans, 30 per cent above the cost of operating the same ships with European crews, and under European conditions.

Now, as far as private capital is concerned, the question of the advisability of operating any proposed line of American steamships is judged purely upon the utilitarian basis of its dividend-earning probabilities. It is not a question of sentiment or patriotism, but of profits; and since it has been proved to a demonstration that, under existing conditions, it is impossible to compete with foreign built and owned ships, the decline and present stagnation of our present merchant marine is readily accounted for.

The Subsidy Bill is a proposal to have the government assist the merchant marine, by paying to the owners of vessels a sum sufficient to make good the difference in cost of construction and operation between American-built-and-operated ships and those of foreign nations. In return for this the merchant marine gives a *quid pro quo* to the government by building certain of its ships to meet government requirements with a view to rendering them available as transports; by assisting in the creation of a naval reserve both of officers and crews, and by holding their vessels at the disposal of the government, and liable to be taken up at short notice in the event of hostilities.

In our issue of January 27 we dwelt upon the urgent necessity for the resuscitation of our merchant marine, if only to provide the government with a system of transport service that would be available, and instantly available, in case of hostilities. We quoted certain figures taken from a report of the General Staff of the Army, showing how completely paralyzed, in the event of sudden war, this nation would be if it attempted to transport a small army of, say, 25,000 men across the seas. It was shown that for the transportation of such an army, either on the Pacific or on the Atlantic Ocean, there should be afloat in our merchant marine no less than 228 vessels of a gross tonnage of 1,368,000 tons, all of them ranging from 5,500 to 6,500 tons displacement; whereas, as a matter of fact, in 1904, the whole American merchant marine included only 57 sea-going vessels of 4,000 tons and upward, with a total of 400,000 gross tons. The argument for subsidizing, from the standpoint of the military necessities of the country, is simply unanswerable.

Judged from the commercial standpoint, the question of ship subsidies is purely one of expediency. None of us are particularly fond of the term subsidy, and some of us have tried to get away from it by a bit of psychological legerdemain which ends in calling it subvention. Be that as it may, however, subsidizing is but a matter of giving heroic treatment to a patient whose case is desperate. There can be little doubt that if the bill be passed and becomes a law, the next ten years will see a notable revival of an art for which this country has proved itself in the past to have splendid aptitude. When once our merchant marine has become big enough to carry the whole of our deep-sea trade, we shall not only have diverted vast annual revenues back to their legitimate channel; but we shall have developed a magnificent industry; given employment to a large army of skilled labor; and caused the American flag to fly once more in a score of seas and at a hundred ports where now it is conspicuous by its absence.

THE "DREADNOUGHT."

Largely because of the unusual circumstances attending its design and construction, the powerful battleship of 18,500 tons displacement, which has just been launched at Portsmouth, England, is attracting more than common interest. The "Dreadnought" is the first battleship to be built since the war; she is the largest and most powerful fighting ship ever constructed; and, as the result of the effort of the government to see just how quickly a battleship can be built in Great Britain, she has been launched in four months, and will be completed in eighteen months from the day on which her keel was laid.

The SCIENTIFIC AMERICAN has received information from the highest official sources in Great Britain that there were present on the ships of Admiral Togo's fleet several British officers, who had been detailed to secure technical information of the valuable kind that can only be gathered in an actual sea fight. The mass of information affecting the construction and management of warships, thus secured, was placed before a special committee, corresponding to our Board of Construction in this country, which called in for consultation, we understand, several expert private naval architects and builders, and proceeded to design a type battleship embodying the valuable experience gathered in the Russo-Japanese war. The result is the mighty ship which was launched on February 10, only four months from the day on which the keel plate was laid.

The "Dreadnought" embodies, naturally, a large number of novel features; but owing to the extreme secrecy which has attended the construction of the ship, and the care with which her plans have been guarded, only the leading characteristics of the design can be stated with certainty. In the first place, the displacement, as compared with previous battleships of the "Lord Nelson" type, has been increased by about 2,000 tons, the "Dreadnought" displacing 18,500 tons and costing, when complete, over $8,000,000. The most radical change, due to the experience gained in the war, is the elimination of the secondary battery and the reduction of the armament to two types of guns, the 12-inch and the 3-inch. It was proved that the 6-inch gun is too light to be effective at the greater ranges at which modern engagements are fought, and that it is not sufficiently rapid in its fire and is rather too heavy a gun to be used for defense against torpedo boats and destroyers, a work for which the 3-inch gun is well suited. The "Dreadnought's" battery consists of ten 12-inch guns, all mounted at about the same level on the upper deck; two forward in a turret, two in a similar turret aft, and three on each broadside, mounted within single turrets. For defense against torpedo attack the ship will carry eighteen 3-inch guns. The 12-inch gun will be of the wire-wound type and about 45 calibers in length. Each gun will throw an 850-pound shell with a muzzle energy of 49,568 foot-tons. Owing to the improved methods of handling the 12-inch guns, they will be theoretically capable of discharging four tons of metal a minute with sufficient energy to penetrate 16 inches of Krupp steel at a range of 5,000 yards.

The armor protection will be particularly heavy and complete, and structurally the ship will be built with a view to resist the severe racking effects, which played such havoc with the Russian ships in the battle of the Sea of Japan. On this point it is interesting to note that Admiral Rojestvensky, in an address before the Imperial Technical Society at St. Petersburg, stated that when the heavy high-explosive shells of the Japanese "exploded in the water near the Russian vessels, they cracked the plates and opened great leaks." Similar effects were noted at the bombardment of Russian ships at Port Arthur, as recently explained in the columns of this journal. At the longer ranges, the shots that fell short, but near the ships, would not explode until they had penetrated several feet below the surface, and were close to the under-water surface of the hull. The Japanese high-explosive shell-filler seems to have acted with the effect of a mine, bulging in the plating and causing serious leaks along the seams. If this be the case, it might well happen that the shots which struck a little short of the ship might be actually in the long run more destructive than those that landed between wind and water. We believe that this problem has been given special attention in the under-water design of the "Dreadnought." Above water the heavy armor has been carried right up to the upper deck, and is nowhere pierced by casemates.

Another important innovation in this new ship is the introduction of steam turbines. There will be four propellers on four shafts, and the estimated speed is 21 knots an hour. If this speed is secured, the "Dreadnought" should be practically invincible, and a fair match for any other two ships afloat, since she could choose her own distance and position, and fight a long-range action with her 12-inch guns. The great speed with which the new ship has been constructed is due to the desire of the Admiralty to subject her to a series of very thorough tests before building any other ships of her class. As she was designed to be launched in six months from the start of work, and was actually launched in four, it is probable that she will be completed within the estimated period of eighteen months from the laying of the keel. The significance of this rapid construction is seen in the potentiality of replacement it suggests if Great Britain were engaged in a lengthy war. There are a dozen yards (including those of the government) that could build one or two ships of this class in about the same time; and this would mean the creation of a new battleship fleet of a dozen vessels in the period covered by the Japanese war.

EVOLUTION OF HEAT FROM RADIUM.

Prof. Angström, of Upsala, Sweden, some time ago conducted certain experiments with a view to ascertaining accurately the amount of heat given off by radium. From these experiments the evolution of heat was shown to remain practically constant during the period of a year, being independent of the nature of the surrounding medium. Thus it may be inferred that the amount of energy given off in the shape of beta and gamma rays constitutes only a minimal fraction of the total energy.

According to recent experiments by Paschen on the same subject, the Gamma rays would, however, constitute more than half of the total energy evolved by radium. In view of this evident contradiction, Prof. Angström (see Physikalische Zeitschrift, No. 21) again took up his experiments with the utmost care and on a larger scale, the experimental conditions being likewise altered. Though Herr Paschen has in the meantime found his own results to be unreliable, an account of these most recent experiments would seem to be interesting owing to the importance of the subject. 86.5 milligrammes of pure radium bromide inclosed in a small metal cylinder were placed in the neighborhood of another cylinder, with dimensions as nearly identical with the first as possible, and which was protected against all heat effects. This cylinder contained a small manganine coil heated by an electrical current. The temperatures of the cylinders were measured with great accuracy by means of thermo-elements, while the amount of heat given off by the radium was found by varying the current traversing the manganine coil until the two thermo-elements showed the temperature of the two cylinders to be strictly identical. The amount of heat given off by the coil (as determined by the current intensity and resistance) was then equivalent to that evolved by the radium, and in order to eliminate any errors due to a lack of symmetry, the two apparatus were repeatedly substituted for one another. The heat evolution thus ascertained was found to be exactly the same whether lead, copper, or aluminium cylinders were used, being 1.136 small calories per minute for each gramme of radium bromide. The energy of both beta and gamma rays is accordingly quite immaterial, being at most a small per cent of the total amount given off by the substance.

The evolution of heat from the radium product investigated by Angström from September, 1903, to January, 1905, was found to undergo no alterations worth speaking of throughout this interval, the mean value according to earlier determinations for the period from September, 1903, to April, 1904, being 1.14 small calories per minute, or 68.5 small calories per hour, for each gramme of radium bromide. The heating effect of radium is thus shown to be due either to the internal collision of the alpha particles, the living force of which seems to be sufficient to bring about rather decided effects, or to some other agent, which is different from the three classes of rays.

EXPERIMENTAL EVOLUTION.

BY DR. HUGO DE VRIES.

What is that in the egg which enables it to develop all the qualities of the bird? Something must be there, and we may even assume that all the separate qualities displayed by the bird have their representatives in the egg.

Now, if it were only possible to get at these representative particles within the egg, what changes might not be effected in the development of the bird! To take a very simple example, the peacock has a white variety, lacking the bright colors of the feathers. If in the egg of an ordinary peacock we could seize upon the representative particles of the color and impede their development, perhaps we would succeed in reproducing the white variety at once and quite artificially.

Obviously this is the heart of the matter, for if once the principle should be discovered to dislocate such a representative, we might apply it to numerous other instances. A white peacock would be no novelty and no gain, but we would be able to make white varieties of other birds and other animals, and perhaps even of the bright-colored flowers, which until now have resisted all endeavors of breeders in this line of work.

Methods of attacking this problem are not at all failing. We might try to kill some of the representative particles in the egg, or to stun them, or to injure them in ever so slight a measure, so as only to retard their development. More than one starting point for such an attempt is at hand. Engelmann has shown us a method of lighting and heating small parts of a living cell. He uses the focal point of a glass lens, which he directs upon the cell while lying under the microscope. If now a very small part is overheated and thereby killed, the remainder of the cell is seen to be still living and apparently uninjured. By refining this method some of the most sensible representative particles might perhaps be killed without too much injury to the others.

Other agencies might be tried. The finest and most effective methods offered by allied sciences must be applied. If one fails, another may succeed.

The process of the evolution of animals and plants must be attacked by direct experiment. This evolution, however, has a long history, covering many millions of years. It, historical part, of course, is not accessible to experimental work. From its innermost nature it must be studied according to historical and comparative methods. In laboratory work we may simply pass it by.

After eliminating this great mass of detail concerning the pedigree of the animal and vegetable kingdom, two points remain, which present themselves for experimental study. These are the beginning and the end. Obviously the real end is not yet reached. Evolution is going steadily on even now. In the same way we may assume that the beginning is not yet finished. The laws that ruled the material world some twenty or thirty millions of years ago must have been the same that are still ruling it in our days. Circumstances may have changed, but it is not very probable that those which permitted life at the beginning and those which have made it possible during the long geological ages should have been widely different. On the contrary, it seems only natural to assume that new life may nowadays originate as well as in former times. It is only a question of where we are to look for it.

On this very difficult point I like to be guided by the genial conceptions of Brooks. In his "Foundations of Zoology" he depicts the primeval seas and their living population. All life must have been limited at those early periods to the high sea; all organisms were floating amid the waves, going only to a depth of some few meters. Here the main lines of the animal and vegetable pedigree must have been produced, starting the great divisions of both kingdoms. The only exceptions are offered by the flowering plants and the vertebrate animals, which seem to have originated on the shores or perhaps on the land itself. As long as all life was in this floating condition, evolution proceeded rapidly and broadened out. Then came a period when, as Brooks says, the organic world made the discovery of the possibility of living on the bottom of the sea, feeding on the sinking remains of the floating world. This great change was the starting point for numerous adaptations and for the evolution of a richness of forms and structures, but without the previous progress in the production of many really new divisions.

It is a very attractive picture. For us it points to the probability that the very first organisms must have been inhabitants of the upper sea, floating on the waves; or they must have been members of the plankton, as it is now called. Thence the conclusion that it is within the plankton that new creations are to be sought for. If really they are still occurring in our days, it must be the high sea that conceals them. Obviously these first organisms must have had the lowest possible degree of organization. They were not cells, they cannot have had any differentiation. They must have consisted of a uniform jelly, with only the capacity of increasing their mass. If such a jelly could be detected, what possibilities would not be opened to experiments on evolution! The chance may seem very small, but then, before Röntgen and Curie there was no chance at all of discovering X-rays and radio-activity. The plankton has to become one of the main points of interest for all who care for experimental evolution.

The other end of the evolutionary development is the evolution that is still now going on. Here we are on surer ground, though even here the methods and the starting points have yet to be discovered.

Two main lines have to be followed. One is the direct study of variability; the other relates to the dependency of this variability on the outer conditions of life. The first line uses the statistical method, while the second relies chiefly on experiment. Both have to be cultivated on botanical as well as on zoological ground.

The experience of agriculturists and horticulturists has long since established the fact that new forms of animals and plants from time to time arise. How they originate is another question, which it is not the task of practice, but of science, to answer. The fact, however, is undeniable, and all observations point to sudden changes or so-called sports as the first beginning. Especially in the dominion of horticulture Korshinsky has shown, by an ample critical survey of the historical evidence, that sudden sports are the prevailing rule and probably even the exclusive manner of originating new varieties.

Such considerations have led to the conviction that what occurs in horticulture must also occur in the experimental garden. If the conditions are the same, why should not the phenomena be the same, too? If mutations are rare in horticulture, the experimenter has only to arrange his work so as to be able to detect rare occurrences in his cultures, too. In doing this I have succeeded in observing mutations quite analogous to the horticultural instances, and collecting all the evidence concerning their ancestry and their descendants as well as concerning the mode of their appearance.

Moreover, I have had the good fortune of discovering a wild plant which is even yet in a condition of mutability. Yearly it is observed to produce new species. It is the large-flowered evening primrose, which bears the name of Lamarck, the founder of the theory of evolution. It clearly shows how new species arise from an old stock, not by continuous and slow changes, but suddenly. The stock itself is not altered by the process nor even noticeably diminished. The new species which it produces arise on all sides. Some of them are in a higher, others in a lesser degree fit for their life conditions; some persist during years, while others disappear nearly as soon as they arise.

This instance of experimental mutation is found largely to agree with the experience of breeders, especially in horticulture, and likewise with the conclusions that have been drawn from comparative studies. The assumption that those species and genera which now consist of large groups of closely allied forms have originated in the same way seems quite undeniable; and as soon as the validity of this generalization is granted for these cases it will have to be considered of general, if not universal, bearing.

Two main lines have to be distinguished: the study of the phenomenon itself and that of its causes. Mutations, of course, cannot be assumed to be a special feature of the evening primroses. They must occur elsewhere, too, and these must be sought. The Oenothera was one of a lot of nearly a hundred species tested as to their constancy; it proved to be the only changeable form among them. By testing a hundred other species or other strains of the same forms it seems probable that one or two new instances of mutability may be detected. The best way is to try the wild species of the nearest environments or of other regions with a corresponding climate, since large numbers of seedlings have to be examined. One or two novelties among thousands of individuals of the common type are not easily found, especially when the differences are slight and new, and thereby apt to be overlooked. Much care is to be given, and the trials have to be repeated with the same species in succeeding years. With increasing experience the chances of discerning the small indications of novelties are rapidly augmented. No differentiating marks, however slight, should be considered as insignificant. All aberrant individuals should be planted separately and protected with all the care required to insure the fullest development. Many of them afterward prove to be only fluctuating variants or to have deceived the experimenter. They are simply discarded. It is quite sufficient if some remain and prove to be mutants. As soon as in this manner a mutable strain will be discovered the greater part of the other species may be excluded, although the search for new mutable species should never be wholly neglected. Each year some new forms should be taken into culture, in order to have sufficient chances of gradually increasing the evidence concerning the occurrence of mutability in nature.

The chief object of this inquiry, however, must be the study of the mutable strain itself. Some of its seeds yield new species, while others are more conservative. Thence the question, Which seeds mutate, and by which causes are they elected to do so? The location of the mutating seeds within the fruit, the position of the preferred fruits on the spikes, the influence of the individual strength of the sundry branches, and many other points have to be investigated. Further, it is probable that the degree of mutability, or, in other words, the yield of mutating seeds, is more or less dependent on the outer life-conditions. Thence the necessity of studying the influence of culture in general, of light and heat, of soil and water, and last, but not least, of manure. Extreme combinations of these factors should be tried to see whether perhaps they may give extreme results.

Underlying all and directing all the efforts should be the hope of obtaining such a knowledge of the phenomenon as would enable us to take the whole guidance of it into our own hands.

SCIENCE NOTES.

Of exploration pure and simple very little remains to be done. The charm of traveling through and describing an entirely new country which may be practically serviceable to civilized man has been taken from us by our predecessors, though limited regions still remain in Central Asia and South America of which we know little in detail. The Polar regions are in a somewhat special category, as their opening up affords few attractions to many people. But a knowledge of the past history of our globe—fit study for human thought—can be gained only by study of the portions still under glacial conditions.

A method for detecting the presence of aniline or salicylic acid in foods has been developed by C. Lawal. Pieces of wool are first prepared, from which the oily matter has been well removed by boiling in a soda solution and washing until all the alkali has disappeared. The substance to be analyzed is diluted with water and filtered. We take 100 c. c. of the filtered liquid, adding 4 c. c. of hydrochloric acid and put in a wool strip. The wool is then washed in cold water, then boiled in slightly acidulated water. In the presence of aniline colors, the wool becomes colored and the color is soluble in ammonia. It re-appears upon acidulation, while the vegetable colors turn to red, green, or yellow in contact with ammonia. To detect salicylic acid, we treat the substance with water and sulphuric acid, taking up the liquid with ether. The latter is then evaporated on a watch glass and the residue is treated with ferric chloride. A violet coloration indicates salicylic acid. A flesh-colored precipitate shows benzoic acid. Should tannin be also present, it must be first precipitated by means of sub-acetate of lead.

Some highly scientific results have been achieved by the Sladen Trust Expedition to the Indian Ocean for the exploration of those waters. One important point which was ascertained, according to Mr. Stanley Gardiner, M.A., Lecturer in Zoology and Fellow of Caius College of Cambridge University (England) who was in charge of the party, was the extension outward of all the reefs, on their own remains or debris, in much the same way as a moraine is formed at the base of a glacier. These masses of rock were found to be thickly covered by various growths and marine animals. Huge stems of black coral (the rarest variety) extending to seven feet in length were secured, though white coral was found to be the principal constituent of the reefs. Numerous quantities of deep-sea fish were secured. The greater proportion of these are believed to be absolutely new and hitherto unknown specimens. Some were possessed of enormous eyes, others had only rudimentary ones scarcely larger than a pinhead, while many were quite blind. It was also ascertained that there is an abundance of life existing at a depth of 1,200 fathoms in waters 2,500 fathoms deep. This floating life comprises the food of whales and other deep-sea fish, and this discovery is of great scientific interest, since it has hitherto been believed to thrive only near the surface. The expedition secured a large number of huge squids of great variety, jelly-fish, and prawns, some of which were six inches in length. Curiously enough, while some of the latter were quite blind, others had eyes of large size. This deficiency in the former was compensated for by long delicate antennae, which in some cases extended to twice the length of the body. Nearly all, however, possessed phosphorescent organs, due to the great depth at which they live.

The first of three turbine steamships for the Great Western Railroad of England has been launched for the Channel service between Fishguard in Wales and Rosslare in Ireland, a distance of 62 miles. These vessels will constitute the fastest turbine steamers that have yet been constructed, the contract speed for the Parsons machinery being 22½ knots per hour. Each vessel will have accommodation for 1,000 passengers.

REINFORCED CONCRETE ON THE PACIFIC COAST.

BY H. A. CRAFTS.

While reinforced concrete as a structural material has attained wide popularity in Europe and the eastern part of the United States, its general use on the Pacific Coast may be said to be almost in its infancy.

Round about Los Angeles it has entered into building operations to a considerable extent, but north of that point, even to the British line, its use has hitherto been very limited.

The steel and brick influences of San Francisco have been sufficiently powerful to exclude it from that city and neighborhood. In fact, San Francisco has an ordinance prohibiting its use within the corporate city limits.

But the ice seems about to be broken, and this will come about through the influence of a single San Francisco firm—the Pacific Construction Company.

Early in 1905 the Willamette Pulp and Paper Company, of Oregon City, Oregon, presented plans to the Pacific Construction Company for a very large paper mill building to be erected in the city named.

The plans called for a brick and steel building, but by advice of F. A. Koetitz, chief engineer and vice-president, and F. M. Butler, secretary of the Pacific Construction Company, the plans were changed so as to call for reinforced concrete in place of brick.

The advice upon which this change was based was given for several reasons. In the first place, the Willamette Pulp and Paper Company were in haste to have their building built, and it was shown that much time could be saved by using reinforced concrete in place of brick.

Another principal reason was the conditions that would naturally surround a building erected in this special location, and devoted to the special purpose of pulp and paper manufacturing. The climate of Oregon City is a very rainy one, and the making of pulp and paper at the same time necessitates the use of a great deal of water; consequently, a building so located and so employed would be subjected to much moisture, both from without and within.

The paper mill building at Oregon City has just been completed, and is one of the largest of the kind on the Pacific slope. It is 339 feet long, 92 feet wide, and its walls are 56 feet high. It has a basement and two floors at the "beater" room end, and a basement and single floor in the machine room end, with 20 feet between floors.

The foundation was laid upon a bed of heavy bowlders from the river. Trenches for the foundation walls were dug in the bowlders, and footings five feet wide put in.

On top of these walls, and reaching up to the sills of the basement windows, the walls of the superstructure were made 28 inches thick; while the main walls of the building were made 12 inches thick, buttressed by 3-foot pilasters, 16 feet on centers, the pilasters being 20 inches thick. These pilasters are reinforced by corrugated steel bars, six bars being imbedded in each pilaster, and held in place by bands of 5/16 round iron, one foot apart. Through the main walls, both above and beneath the window openings, and extending the entire length of the walls, corrugated steel bars were also used.

Interior, Showing Finished Concrete and Steel Columns and Floorbeams.

Constructing the Wooden Forms for the Floorbeams.

Supporting the floors are concrete columns 20 x 24 inches in size and 16 feet apart lengthwise of the building, and at varying distances crosswise of the building, the distances being regulated to accommodate the machinery, and there being four lines of columns.

The main girders running lengthwise of the building are 20 x 36 inches, and the cross beams connecting thereto are 14 x 26 inches. The columns are reinforced by corrugated steel bars, four in each column, connected and held in place by 5/16 round iron. The beams are reinforced by both Kahn and corrugated bars. The floors comprise concrete slabs of an average thickness of six inches, which are reinforced by expanded metal. The top is finished with the usual sidewalk finish. In the basement story are also placed numerous piers for carrying the weight of the line shafts and paper mill machinery, all being reinforced by the same material as used in the beams.

The materials used in the manufacture of the concrete consisted of local Willamette River gravel and Columbia River sand mixed with Teutonia cement.

The form sheathing was beveled 1 x 6 surfaced boards.

The roof trusses are steel girders spanning the whole 92 feet width of the building, and the roof covering is of wood felt with graveled top.

The materials entering into the manufacture of the concrete were landed upon the bank of the river near the site of the building, loaded into cars with an electric derrick, and the cars were then run to the mixer hopper.

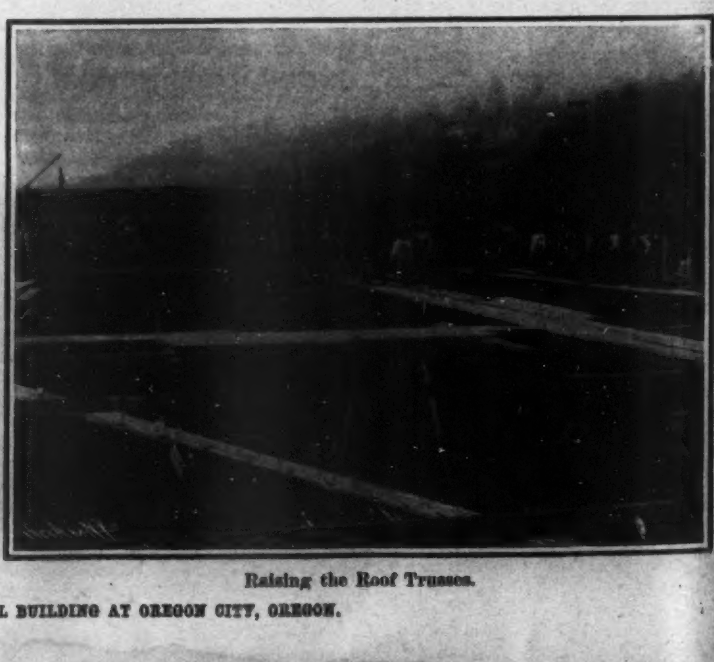
After passing through the mixer the material was delivered into wheelbarrows, and the loaded wheelbarrows were raised to the required height by electric elevators.

The building was completed within a period of six months, and cost the paper company in the neighborhood of $100,000.

Some New Facts About Animals' Eyes.

For some years past the eminent British ophthalmologist, Dr. Lindsay Johnson, has been investigating the eyes of animals, and has made some valuable discoveries of great interest to zoology and our knowledge of the evolution of various animals. One of the most remarkable of these researches is a confirmation of Darwin's theory that man is closely related to the primates. From his investigations Dr. Johnson has found that the eyes of all the apes, including man, are practically identical. Each has the highly complex system of veins and arteries, and the direct or parallel vision. According to this authority, the dog has two ancestors, one round-eyed and the other oval-eyed. The first is the hyena, and the latter the bear through the raccoon. All animals exposed to chase by enemies, such as the hare, rabbit, and squirrel, can see all around, and all the rodentia squint. The lower an animal in the scale, the further is its eye from parallel vision. According to this authority also, the corpus niger, or black body of pigment, in the eye of the horse, which has proved such a source of speculation to the naturalist, veterinarians, and zoologists, reveals through the ophthalmoscope a new means of tracing the ancestry and relationship of the horse. The eye curtain is precisely the same as that which is found in all tropical animals, such as the onega, camel, antelope, etc., and fulfills one important function—the protection of the

View Showing the Wooden Form for Erection of Side Walls.



Raising the Roof Trusses.

CONSTRUCTION OF A CONCRETE AND STEEL BUILDING AT OREGON CITY, OREGON.

eye from sunlight. One result of Dr. Johnson's researches, according to Prof. Ray Lankester, the celebrated zoologist, will necessitate a reclassification in one section of zoology.

A GRAVITY CABLE RAILROAD IN THE SWISS ALPS.

One of the most remarkable railroads, that constitute such a feature of railroad communication and construction in the Swiss Alps, is that connecting Lauterbrunnen with Mürren. The former township, which is in the valley, is the terminus of the Bernese Oberland railroad, connecting Lauterbrunnen with Interlaken, and forming part of the Bern-Mürren trunk line. Mürren, however, is a small Swiss village situated in the Bernese Oberland, 5,385 feet above sea level, on the opposite side of the valley which is crowned by the Jungfrau. The mountain side is particularly steep, and the railroad stretches from Lauterbrunnen to the Grütsch Alp, 4,890 feet above sea level. Its terminus constitutes one of the most remarkable engineering feats in Swiss railroad engineering.

The track has a striking resemblance to a ladder, so sharp is the angle of the gradient. The mountain face is very rugged, abounding with small, sharp ravines, through which the mountain torrents rush toward the lower-lying country and river, which extends through the valley. The consequence is that in order to negotiate these undulations in the ground, it was necessary to erect viaducts, so as to insure a uniform gradient. These viaducts, of which there are several, are constructed of rough masonry on the small-arch principle with thick, stout piers carried to a substantial depth, to obtain sufficient rigidity to withstand the pressure of the torrent waters in the rainy season.

At other places the track extends through cuttings, and the ballast removed from these sections was employed for strengthening the embankment at points not too well served in this respect. Upon the inclined plane thus constructed the railroad is laid. The rails are carried upon transversely-laid sleepers. There is only one track; but as the railroad is operated upon the simple though highly efficacious principle of raising a pendant weight by the connection of a heavier one upon the other end of the attachment, there is a half-way station, where the ascending and descending cars pass, and at this point the track resolves itself into two loops.

The total length of the railroad from Lauterbrunnen to the Grütsch Alp is 4,530 feet, and the average gradient is 55 in 100, with a maximum of 60 in 100. Down the center of the track is laid a rack rail, in which runs a cog wheel carried underneath the car, which not only greatly assists the car in climbing, but in the descent acts as a highly efficient restraint over the force of gravity.

The railroad is operated by cable, the ascending car being connected by a wire rope, which passes over a drum in the power house at the summit, and thence to the descending car. The cables furthermore are water-balanced. Large pulleys are placed at frequent intervals to carry the cable.

The cars are self-contained, and start from the opposite ends of the road simultaneously, telegraphic communication being maintained between the two termini for purposes of signaling. Each car carries a water-ballast tank, but only the descending tank car carries the water-ballast charge, in order to impart the necessary momentum to overcome the inertia of the car stationary at the lower station. As the car descends, water is gradually emptied from the tank. The displacement of the water coincides with the weight of the cable, which lengthens as the ascending car approaches the top. The skillful manipulation of this water ballast constitutes one of the most important factors in the safe operation of the railroad. Each car must travel at the same speed, and progress must be steadily maintained, so as to obviate any sudden jerks, which would throw severe strains upon the cable. Upon each car is attached a time indicator, and the rate of progress is regulated by the authorities. In order to guard against any inadvertent acceleration in the velocity, a powerful automatic brake is supplied to each car. Should the speed exceed that which is prescribed, the brakes come into operation, and thus check the engineer's progress. As a further precaution against careless or reckless driving, the engineer is subjected to a scale of fines, which are rigorously enforced by the authorities, information concerning this point being supplied by the time indicator.

To guard against any disaster resulting in the remote possibility of the cable rupturing, and to prevent the car running away and getting beyond control, each vehicle is equipped with two powerful brakes in addition to the automatic brake, and these, in conjunction with the cog wheel placed beneath the car, are sufficient to hold it stationary upon any part of the gradient. Accident is thereby adequately provided against, and it is this careful braking system which is responsible for that element of safety so characteristic of these mountain railroads in Switzerland. The cars pass each other at the half-way point by means of a turn-out provided for the purpose; and at this point a momentary stop is made.

The cable has a breaking strength of 63 tons, and it is a splendid testimony to the care used in making it, that the same rope is in use to-day as when the railroad was first opened. The cable is thoroughly inspected at frequent intervals, and not even the weakening of a single strand has been discovered. The cars travel at the rate of 226.35 feet per minute, the whole journey occupying 20 minutes. This rate of progress is much greater than that attained by the locomotive-operated mountain railroads, such as the Rigi, where the speed is only 186.35 feet per minute, and the maximum gradient in three miles is 48 in 100. There is one other important cable-operated railroad in the Swiss Alps, that at St. Beatenberg. This railroad, which also has a maximum gradient of 60 in 100, is 12,795 feet in length and occupies 50 minutes to negotiate. Though the Mürren railroad is of practically the same gradient throughout, the St. Beatenberg track at one section has a rise of only 34 feet in 100, to cover which occupies 15 minutes.

From the Grütsch Alp station extends an electric railroad of the conventional overhead trolley type to Mürren. During the whole of the journey to the latter terminus, a distance of 3¼ miles, the railroad has only to climb 495 feet, the gradient thus being a comparatively easy one. The train is hauled by an electric locomotive. The whole journey from Mürren to Lauterbrunnen, including the negotiation of the cable section, occupies 55 minutes, and the fare charged is 75 cents.

CAR CROSSING A STEEP VIADUCT ON THE LAUTERBRUNNEN-GRÜTSCH ALP GRAVITY CABLE RAILWAY.

A water ballast tank below the car is filled when the car reaches the top, thus causing it to descend and raise the other car owing to the difference in weight.

One of the oddities of our nomenclature is that the combination of metals known as German silver contains no silver in its composition, and is of Chinese and not of German origin, says the American Machinist. It was first introduced into Europe by the Germans, and for some time it was not generally known that they had simply borrowed it from the Chinese.

Automobile Notes.

In place of the Bennett Cup race the new Grand Prix race will be held this year for the first time in France over the Sarthe circuit. This circuit is located some three hours ride by rail from Paris. It is practically an equilateral triangle, about 100 kilometers (62 miles) in length. The lengths of the three sides are: La Fourche-St. Calais, 34 kilometers; St. Calais-Ferté Bernard, 31½ kilometers; and Ferté Bernard-La Fourche, 34½ kilometers. An innovation is that the race will probably be run on two successive days—360 miles a day—and that a different driver may run the car each day. A new rule is that only the driver and mechanic of a machine may change the tires.

The automobilist who has never seen a racer in action on the road can form a very good idea of how one of the huge machines appears by paying a visit to the "Vanderbilt Cup," a new play which has been running for the past several weeks at the Broadway Theater. In this drama a race between two high-powered monsters takes place in full view of the audience, the Gatling-gun effect of a racer being very realistically portrayed by means of an actual four-cylinder motor using alcohol as fuel and belching out blue flames at the audience. The wheels of the machines revolve rapidly, the background flashes past, and, at the critical moment the right machine pulls ahead and wins. Another particularly good effect is the representation, by means of cinematographic views taken from the rear of a moving machine, of the trip of two automobiles (one in tow of the other) from a country town to New York. A galloping horse photographed in the same way furnishes a very striking illusion.

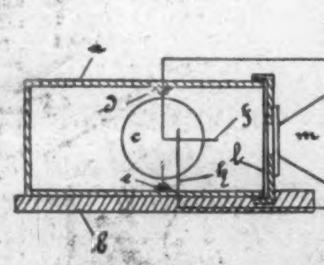
The second annual Cuban road race for the Havana Cup was run on the 12th instant over a distance of 218 miles, and was won by Demogeot on the 80-horse-power Darracq racer, which carried off the Vanderbilt Cup last October. Four runs over the 54½ mile course were made by the winner in 54:26, 51:06 1-5, 58:09, and 54:37 3-5 respectively. The total time was therefore 3 hours, 38 minutes, 18 4-5 seconds, which corresponds to an average speed of about 60 miles an hour. Bernin, on a 90-horse-power Renault, made the fastest time on his first trip out to San Cristobal, which was made in 51:04; but on the return trip he consumed more than the 90 minutes allowed, and was declared out of the race. Lancia and Cedrino on 110-horse-power Fiats both came to grief at a sharp curve near Candelaria. Lancia stopped to look after his mechanic, who was thrown out of the car; while Cedrino's car capsized, and he and his mechanic were both injured. The course was oiled with a mixture of crude oil, water, and asphalt. It was in good condition, and there was no dust.

There has been much talk of late about using the engine as a brake when descending a hill, and thus saving unnecessary wear on the brakes. All that is necessary is to cut off the ignition current when running on the high speed, for instance, and let the car coast. The foot brake can also be applied gently if needed. If the hill is a steep one, and there is doubt about the brakes holding, the car should be set on the intermediate or low speed before starting to make the descent, as it is practically impossible to shift back if the car gets going rapidly. The action of the pistons in drawing in and compressing the gas forms a powerful brake, especially when the lower gears are engaged. The only disadvantage is that when the ignition current is again switched on, there is apt to be an explosion in the muffler, which may damage the latter. To obviate this disadvantage an air valve of some sort should be fitted between the carbureter and the motor. Then, when the motor is being used as a brake, it can be made to draw in air instead of gas. This will cool the cylinders without consuming fuel, and will effectually do away with muffler explosions. This valve, if arranged so it can be opened gradually, may be used as a throttle by producing dilution of the mixture, which is a much better and more economical way of throttling than that ordinarily employed.

As a result of a prize competition for the best automatic starting device for the motor of a gasoline automobile, several of the leading makes of cars at the Paris Show were fitted with automatic starters. One of the best of these was that shown on the Mors car. This is an automatic starting device, consisting of a hand pump having a piston of 5 or 6 inches diameter for forcing gas into the cylinders. The pump is located behind the speed change levers and beside the driver's seat. On the suction stroke it draws air through a small surface carbureter known as the "dynamogene" and located on the dash. The gas thus formed is forced into the cylinder through a special valve which has been previously opened. This valve is then closed, the spark switched on, and the motor starts. The Renault starter is a more elaborate device, consisting of a compressed air tank resembling a 5 cubic foot gas cylinder attached to the chassis under the driver's seat. This is kept charged by a connection with a non-return valve to the rear cylinder head. On the left of the flywheel, which has a ring of teeth attached to it, is a very small and compact three-cylinder motor. A lever on the dash simultaneously throws a pinion on the shaft of this latter into gear with the flywheel and opens the air valve to the small motor, which starts under the pressure of exhaust gases collected in the gas cylinder. Another starter has a ratchet actuated by depressing the clutch pedal to its full extent, engaging with a ratchet wheel on the engine shaft.

DETONATION OF SUBMARINE MINES BY MEANS OF SOUND WAVES.

A singular phenomenon has been recently observed on tube-shaped resonators in the interior of which thin disks of any rigid material are suspended, so as to be readily susceptible of rotation. In fact, if the characteristic sound of the resonator be given off, the disk was found to rotate until its surface was at right angles to the longitudinal of the resonator, remaining in this position as long as the sound in question was continued, and returning to its initial position as soon as this ceased. Other sounds of any intensity were found to be unable to produce a rotation of the disk. Now this phenomenon, according to a recent issue of the Technische Rundschau, has induced an inventor to construct a device in which an electrical current is switched on or off, reinforced or weakened, by the rotation of the disk, thus disengaging forces of the most varied description. One of the most remarkable uses this apparatus may be applied to is the detonation of mines without conductive connection between the apparatus and the sound generator. In the illustration herewith, *a* is the tubular resonator resting on a foundation *b*, and in the interior of which a thin disk *c* has been arranged in the bearings *d e*, so as to be readily susceptible of rotation. To the disk *c* is fixed a contact-lever *f*, projecting above the latter and connected at the top of the bearing *d* to one of the terminals of a battery *g*. The other terminal of the latter communicates through a conductor *h* with the primary coil *i* of an electrical ignition apparatus, as well as with the contact lever *k*, which is placed in the path of the contact lever *f*. In order to protect the disk and



DETONATION OF SUBMARINE MINES.

contacts against atmospheric influences, the resonator is sealed at its upper end by a membrane *l*, of rubber or the like, a funnel *m* being arranged above this membrane to reinforce the sound effect.

If the apparatus be connected to a mine arranged on shore close to the coast, when a signal is given from a torpedo-boat siren which is tuned to the characteristic sound of the resonator *a*, the disk *c* will be set rotating, and the lever *f* will touch the contact arm *k*, thus closing the circuit of the battery *g*, and producing an igniting spark, which will result in an explosion. The disk *c* before operation is held by a weak spring or the like in a position neither at right angles to the longitudinal axis of the resonator nor susceptible of producing a contact between the levers *f* and *k*.

In order to prevent an involuntary explosion, which might result from a signal given by the siren of some other warship tuned by chance to the same sound, means may be provided to enable the ignition to be produced only after a certain number of signals have been given. This invention seems to be preferable to the ignition by electrical waves which has likewise recently been suggested, as an involuntary ignition is more liable to be produced with the latter, owing to the numerous applications of wireless telegraphy.

The Current Supplement.

The current Supplement, No. 1573, opens with an article on the Interborough Rapid Transit Company's test of Subway engines. The use of alcohol as fuel for internal-combustion motors is discussed. James Swinburne writes on efficiencies with his usual force and clearness. One of the best articles that has ever appeared in the Supplement is that by Lionel Calisch on single-phase alternating-current railway work. The physics of ore flotation is discussed by J. Swinburne and G. Rudorf. Prof. Jacques Loeb, whose recent investigations in biology have attracted worldwide attention, writes on the changes in the nerve and muscle which seem to underlie the electrotonic effects of the galvanic current. Louis H. Gibson contributes an article on the principles of success in concrete block manufacture.

The Deutsch-Archdeacon Prize for Flying Machines.

In view of the widespread interest in flying machines of the heavier-than-air type at present, the rules of the Deutsch-Archdeacon $10,000 prize contest for the first machine of this type to make a successful flight in France will be of interest. Additional prizes, which may be competed for by either airships or flying machines, were noted in our issue of February 10.

1. Any type or size of apparatus may compete, provided it does not rely for its suspension on any gas which is lighter than air, nor have any material connection with the ground during its flight.

2. Those desiring to make a trial must notify the Aero Club de France.

3. Each entrant must send a fee of fifty francs before he makes his trial. The entry fee is not returnable; it covers all trials made by the entrant during one day only.

4. Notification of a trial must be made in time for the Aero Club officials to be advised on the previous evening at least. Should the trial ground be far distant from Paris, the notification must be sent in earlier than this.

5. Trials will be only recorded between sunrise and sunset.

6. The committee reserve the right of refusing to officially observe a trial if the *bona fides* submitted to them are not considered to give sufficient evidence of extensive private experiments. On this point their decision is final.

7. Only one entrant may make trials during one day, if there are more entries, the others must compete on successive days, following the first.

8. Entrants must specify the starting and turning points, which must be separated by at least 500 meters.

9. Trials must be held in France, and if conducted outside a radius of 40 kilometers from Paris, the competitor must bear the expenses of the official observers.

10. Trials may only take place in the presence of club officials. The "start" will be considered to occur when the machine ceases to touch the ground. If the experimenter does not wish to alight on returning, he must drop some object on the ground within a radius of 25 meters of his starting point.

11. The club officials may take any steps for the general safety, but are, nevertheless, not responsible for accidents.

12. The prize may be competed for within five years from the 1st of October, 1904.

Quartz Vessels and Apparatus.

In 1899 M. Heraeus succeeded in melting a considerable amount of quartz in the oxy-hydrogen furnace, using iridium crucibles, as this was the only metal which would stand temperatures as high as 1,850 degrees C. without melting or acting on the material under treatment. Later on, in connection with the work of Siebert and Kühn, he attempted to form vessels and apparatus of quartz. The technique of the process gives rise to two main operations. The first is the fusion of the quartz. It is brought to the proper temperature to modify its structure, and this causes a change of the optical properties. Near 570 degrees the large pieces split up into fragments. This had led Shenstone to make certain researches in 1901, but without being able to treat the large pieces by the blowpipe otherwise than by a double operation. Shenstone's method consists in heating the large pieces to 1,000 degrees and quenching them in water, thus procuring a material which had lost all transparence, or nearly so, but which when reduced to fragments could be vitrified by the blowpipe. This process, taken up by Heraeus, only gave a quartz glass which was full of air-bubbles. To remedy this he was obliged to return to the current method which consists in melting the matter in iridium or iridium-ruthenium crucibles placed in a refractory furnace and heated by the oxyhydrogen blowpipe. The vitreous modification is produced at about 1,700 degrees or 80 degrees above the fusing point of platinum. Such a product has only very large air-bubbles, which are suppressed by keeping the bath fluid. This is easily possible, as iridium tubes are made now which resist 2,000 degrees for a long time. In the second place we have the fabrication of the quartz vessels and other apparatus. Shenstone's first attempts gave only very small ones. Later on, Kühn made vessels up to 50 c. c. and larger by joining together smaller pieces which were obtained by blowing. However the process of making quartz vessels is a delicate one owing to the great heat of the melted matter. New methods would be of especial interest, for the quartz is of great use in industry, as it is not attacked by acids, water, saline solutions, and it can undergo varied oxidations at high temperatures. Care must be taken in this case that the pieces are quite clean and do not come in contact with the hand or with other objects.

Correspondence.

The Balanced Cable Crane.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 27 there appears an article on a "New Overhead Traveling Gear for Expeditious Construction in Shipyards," which was written by your English correspondent, and in which it is stated that the credit of having devised the system belongs to Mr. John Henderson. You will find in your issue of August 10, 1895, what we believe to be the first published account of this system. So far from its being an English invention, we beg to assure you that the "Balanced Cable Crane," as it is called in this country, is the invention of an American engineer, W. F. Brothers, of Brooklyn, and that he has protected himself in the United States and Europe by numerous patents, the first of which was taken out in 1895.

BALANCED CABLE CRANE COMPANY.

Brooklyn, N. Y., February 7, 1906.

Bewildering Conceptions.

To the Editor of the SCIENTIFIC AMERICAN:

The writer enjoyed Prof. Larkin's splendid article, "New Conceptions in Astronomy," published in your issue of February 3, 1906.

The unthinkableness of this vast myriad of suns, alive and dead, in constant motion, in this awful limitless space around us, is enough to drive man to insanity, or back to the sullen beast, from which he sprung, were it not for knowledge of the Purpose that leads him on.

But there are wonders and problems in us, and around us, as great as the mysterious suns and equally beyond our mental conception. The life in insect or man, the conception of life, thought itself, the constant pumping of the blood, chlorophyl in the leaf, the odor of the flower, memory, electricity, the life in a lump of coal or radium, crystallization—all would snap the mind, if probed too far and too intense.

The only relief is knowing that there is a Purpose through it all, and that the good or evil impulses of life are of man's choice. If good, he lives and becomes a part of the great vibration; if evil, his spiritual life is lost. This Purpose has raised man from a fierce animal, probably originated in the jungle of the Malay Peninsula, and has led him by the hand through forest, field, and over seas, from densest ignorance and superstition, through many backfalls and retrogressions, to what he is in this the twentieth century. Every step of the way has had to be battled for, and no problem, however black it appeared, but has had the light beyond. All will be won through man's endeavor. If it were not for this slow but ever-forward guidance to the Ideal, life would seem hopeless, and all endeavor vain.

W. GOODRICH JONES.

Temple, Texas, February 6, 1906.

Cooling Gas-Engine Cylinders.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of January 20 the article by Mr. S. M. Howell on the cooling of gas-engine cylinders contains statements which, while to a certain extent theoretically correct, are so very much opposed to practice, that attention should be called to the same.

In the first paragraph of Mr. Howell's article it is stated that an air-cooled cylinder will develop more power than that secured from a water-jacketed cylinder of the same size. While in theory this might be possible, in practice it is absolutely incorrect. The excessive heating of the cylinder, apart from any other drawbacks, heats the incoming charge to such an extent as to prohibit the necessary amount entering the cylinder to enable the engine to develop its rated horsepower. Disregarding jacket losses, a cold gas-engine cylinder will develop very much more horse-power than a hot one, owing to the fact that it will take up a very much larger volume of gas per stroke. In practice the jacket losses where the cooling water is kept at a temperature of 180 deg. F. are found to be as small as it is possible to make them under any conditions.

The most important means of reducing power losses through jacket radiation have been the changing of the design of engine construction, so that the valve chamber usually employed is obviated, and the valves open directly into the head of the cylinder; by this method as much as 50 per cent of radiating surface is eliminated without any attendant disadvantages.

Referring again to Mr. Howell's article as to complete combustion of the fuel gas in an engine cylinder, this altogether depends upon the time of ignition. For example, if the cylinders were quite cold, complete combustion could be obtained at the right period of the stroke by having the ignition start early enough. This the writer has proven in practice by exhaust gas analysis.

Referring to the method suggested of having the active part of the cylinder lined with a refractory nonconducting material which would be maintained at a dull red heat, the writer begs to state that in such an arrangement it would not be necessary to have any compression at all so far as ignition goes, as the temperature of the walls would attend to that matter immediately upon the combustible charge entering the cylinder.

Referring to the suggestion of compounding a gas engine, this is a matter which is under wide discussion in the gas-engine field, but about which the consensus of opinion seems to be that compounding is more detrimental than otherwise, owing to the back pressure supplied to the high-pressure cylinders interfering with their free exhaust. Also the figure stated of 100 pounds pressure per square inch of exhaust gas is incorrect, as the average exhaust pressure will be found to be only 20 pounds per square inch. So that the actual losses from this source are not as high as figured in the article referred to.

Compounding a gas engine is a very different proposition from compounding a steam engine, for the reason that we have no condensing effect from the gas engine exhaust to help us out in our economies, as we have in the steam proposition.

To sum up, the writer feels that the engine construction as outlined by Mr. S. M. Howell, however practical from a theoretical point of view, would prove a very undesirable engine in practice, even if the inherent disadvantages of this construction were overcome sufficiently to admit of its operation.

GODFREY M. S. TAIT.

New York, January 20, 1906.

An Anticipation of the Gas Engine with Refractory Lining.

To the Editor of the SCIENTIFIC AMERICAN:

In an article by Mr. S. M. Howell appearing in the January 20 issue of the SCIENTIFIC AMERICAN, a sketch and outline of operation of an alleged new type of internal-combustion engine are given.

An engine of this type, designed by the writer, was exhibited at the Canadian National Exhibition, September, 1905, and attracted a great deal of attention there. In this engine are embodied all the points of advantage enumerated by Mr. Howell, such as a heat-insulated combustion chamber, a piston extension with heat-insulated cap, which prevents the hot products of combustion from coming into contact with the cold cylinder walls, injection of fuel at the beginning of the power stroke, etc. This engine is single-cylinder, horizontal, 8-inch diameter by 8-inch stroke, 300 to 350 R. P. M. Compression constant at 150 pounds per square inch (charge of air always full cylinder volume). Governed by varying individual charges of oil to suit load.

At this exhibition the engine was running under about half load, driving a centrifugal pump, pumping water over an artificial waterfall. The engine ran about eleven and one-half hours each day, no stops. Oil consumption about one-tenth gallon per horse-power hour; crude fuel oil, six cents per gallon, barrel lots, f. o. b. Toronto.

This engine represents the results of about two years' hard and steady experimental work. Now that the ground has been gone over, everything appears quite simple, but to work out a practical construction from the given theoretical considerations is a much greater task than one who has not tried it would imagine. The writer has experimented with over fifty different substances for the interior lining of the cylinder, scores of fuel-injecting devices, to say nothing of the hundred and one little devices that require a painstaking course of study and trial before their defects are eliminated. These latter comprise oil force pumps and charge-measuring devices, starters, preliminary heaters, modes of fuel injection, arrangement of valves and valve gear, air pumps, governors, etc.

For two months after the first engine was constructed it did not develop enough power to keep itself in motion, the M. E. P. then being only about ten pounds. From this it was gradually raised step by step, the highest M. E. P. yet recorded being one hundred and three pounds per square inch.

The engine will now run on any liquid fuel, has never needed cleaning out, and has no electric nor hot-tube igniter.

An illustrated description of this engine appeared in Canadian Machinery for September, 1905, and in other Canadian trade papers.

H. ADDISON JOHNSTON.

Toronto, Canada, January 25, 1906.

Reducing the Skin Friction of Vessels.

To the Editor of the SCIENTIFIC AMERICAN:

I note the article by a correspondent, published in your issue of January 6, about the suggestion of using air bubbles for lubricating the immersed bottom of ships for their easier propulsion in water. The idea is a good one, as it is an established fact that the power needed by a vessel increases tremendously as the speed gets greater; i. e., if 1,000 horse-power are required for 12 knots an hour, for a certain ship, maybe 12,000 or 15,000 horse-power or more will be needed for 24 knots an hour for the same vessel.

For my part, I believe that the lubricating with oil or some greasy substance, is the best scheme for diminishing the water friction. But how could such a lubricant be made and used permanently on all the bottom of the ship? That's the question. I have made many a time the following experiment: I take a flat piece of soap, pretty nearly all used, between the thumb and forefinger and press it in a basin of water, shooting it through the liquid, just as a child would shoot a cherry stone through the air. The piece of soap travels easily through the water, as if it did not meet any resistance at all, while any other similar shaped object, handled in the same way, would hardly move an inch before stopping entirely. Also, if while bathing, one rub his whole body with soap, and let it dry a few minutes, he can notice, when he starts to swim, with what ease he can propel himself. The skin of fish secretes more or less a certain greasy substance which greatly facilitates their motion through water. In fact, all aquatic specimens have their bodies covered with a glutinous substance. Why not apply the same principle to ships? First, experiment with fast launches provided with high-powered engines, next with swift sail-boats, and they will be surprised with the increase of speed attained.

ALBERT VIVIAN.

Santa Anita, Cal., January 11, 1906.

A Correspondent Not in Favor of Saving Niagara.

To the Editor of the SCIENTIFIC AMERICAN:

I have become interested in the questions that are being offered and published in your paper of how to save Niagara Falls.

As a disinterested engineer, and a reader of the SCIENTIFIC AMERICAN for fifty years, I will say that I don't want to see them saved merely for optical or sentimental purposes, for practical utility should always, from a humanitarian standpoint, displace sentiment.

It is a fact that the present useless, enormous waste now passing down the Niagara River, can be beneficially used and applied for the good of mankind. And I can see no reason for saving the chartered syndicates that have constructed power plants about the Falls, by creating an agitation that will prevent other companies from organizing and securing charters for utilizing the balance of the power now being lost to humanity by lack of the necessary works to obtain this unused energy, which can be made a source of industry, wealth, and comfort.

During the summers of 1903 and 1904 I visited the Falls and its surroundings very frequently, and derived a great deal of pleasure from viewing the magnificent power plants then completed and in progress of construction. But I am not in favor of Americans losing the benefits that they can obtain from the erection of power plants, by giving the Canadian companies the advantage they have discovered they can obtain, if temporarily they can prevent the granting of future charters, concessions, or rights for using the power of the Falls.

The incentive or the basis of all the discussion now taking place, is how to save the present syndicates. The leading agitators are the security holders, who ask for high-paying dividends, and are opposed to the intrusion of other or later competing companies, who would enter the field and sell power at lower figures than themselves.

The Canadian side of the river offers superior advantages over the American, as the total fall they can obtain will, if good engineering methods are followed, amount to over three hundred feet.

IRVIN A. FORT.

North Platte, Neb., February 8, 1906.

Freezing Point of Cod-Liver Oil.

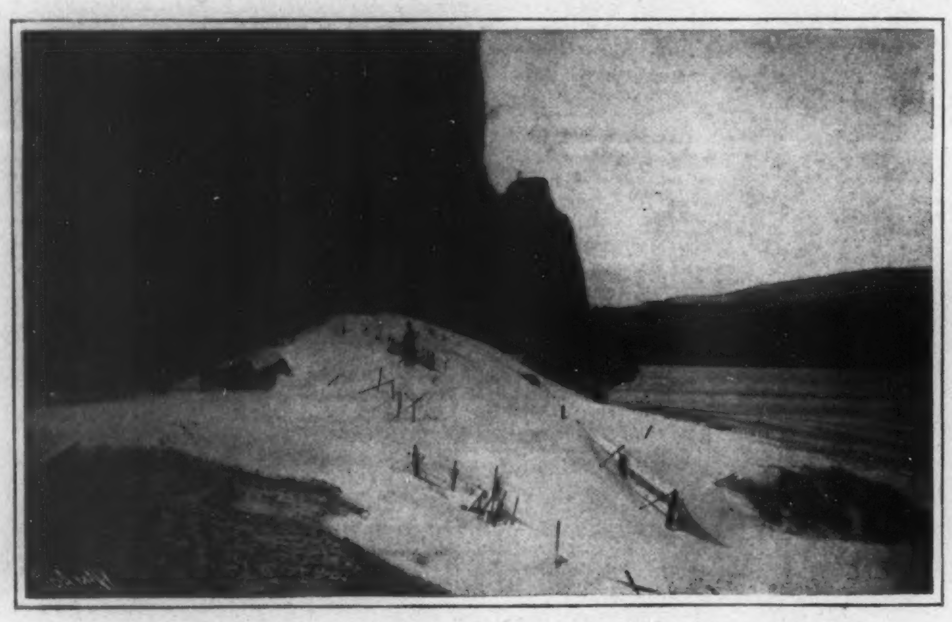
The different treatises on the subject state that cod liver oil should not freeze at zero degrees C. unless it has been adulterated, and in France the Commission of the new Codex has also accepted this characteristic, and it is to be required for medicinal cod-liver oil. But according to the researches of B. Moreau and A. Biétrix it appears that there are specimens of this oil which do not correspond to such case. They observed different samples of oil which were certainly of natural origin, and arrived at the following conclusions. Contrary to the usually-accepted ideas on the subject, there exist at present in commerce among the medicinal cod-liver oils certain absolutely pure oils which are cloudy in winter, because they have not undergone a previous cooling and filtration, and as for all the oils, the deposit only dissolves completely at a rather high temperature. Thus the appearance of cloudiness due to cold does not show an adulteration, but on the contrary is a natural characteristic of pure oils. This cooling of the oil does not seem to remove their active properties. The congealed and non-congealed oils are not found to be different in their usual qualities, as demonstrated by tests for iodine, saponification, percentage of iodine, etc.

SAND WAVES AND THEIR WORK.

BY DAY ALLEN WILLEY.

The formation of sand hills or sand dunes along the Atlantic seacoast of the United States is so frequent, that these eminences are common sights, especially on Cape Cod peninsula, the coast of New Jersey, as well as in the vicinity of Cape Henlopen, Cape Henry, and on the beaches of North and South Carolina. It is perhaps unnecessary to say that the dunes are created by the action of the wind upon the sand, which is washed up by the waves. They are termed fixed or wandering dunes according to their formation; for unless one is sufficiently covered with vegetation, the force of the wind currents continually changes the position of the sand to such an extent, that the hill travels in the direction of the prevailing breezes at a rate depending upon their force and constancy. Measurements which have been taken in southern New Jersey, as well as Massachusetts, show that in a year a wandering dune may move from 15 to 20 feet. Unfortunately, the sand is continually shifting to such an extent, that there is little opportunity for seed which may be deposited upon the surface to germinate; and even where shoots appear above the surface, unless protected in some manner they are soon killed by being covered over or cut off by the contact of the flying sand particles. Consequently, the movement of a shifting dune is seldom checked until it has changed its location to such a point that it is less exposed to the wind current, when it may become fixed by the growth of vegetation upon it. The formation of the coast dune has a parallel in the sand waves, as they are termed, which are found in various localities inland, since they are due entirely to the action of the wind currents on loose material of this kind; and where the topography is favorable, so many waves are formed that they have been termed sand seas, as one can see ridge after ridge reaching backward for miles, and bearing a striking resemblance to the waves of the ocean. Not only in the United States are to be noted examples of this kind, but in some portions of the Sahara in Africa, and especially in the Turkestan desert, although the valley of the Columbia River in Oregon and Washington probably contains as remarkable illustrations of the action of the wind as any part of the world. Picturesque as is the view along these sand ridges, unfortunately they afford a perplexing problem for residents in this vicinity to solve, as they frequently overwhelm the railroad tracks, and would engulf buildings if steps were not taken to prevent their encroachment. For a considerable distance the tracks of the railway owned by the Oregon Railroad and Navigation Company are built through this valley between the Dalles and Wallula. Such is the movement of the sand, that on a windy day it is literally impossible to keep the tracks clear of the drift by means of shovels, and unless extraordinary measures were taken, the railroad would soon become buried to a depth of many feet.

An excellent opportunity has been given in the Columbia Valley to study the exact effect of wind currents blowing in different directions, since the high bluffs cause eddies and miniature whirlwinds, which also act upon the sand, as well as what might be called the direct currents. The changes made in the sand waves by various forms of barriers have also been carefully studied, and as a result some valuable data have been secured. It has been found that when the wind sweeps over a free surface of drifting sand, it acts about equally throughout; but an obstruction of any kind, such as a log or a bunch of grass, at once modifies the action of the wind. A solid object increases the force of the wind around the sides, and hence the sand is excavated. In the lee of the object the sand will accumulate. If two such obstructions are near together, a channel is formed between them, and once formed deepens with astonishing rapidity.



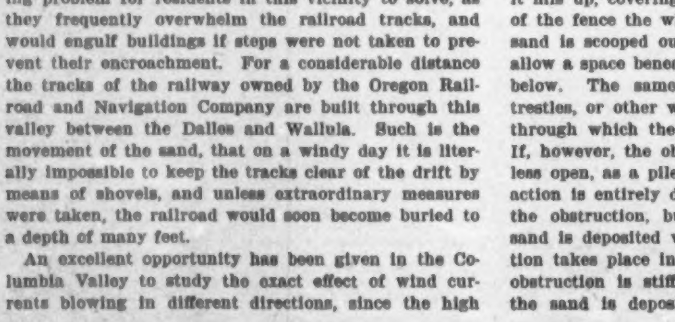
Railroad Men Fighting the Sand Sea in Oregon. The Track Can Be Seen to the Left Partly Buried.

The carrying power of the wind increases much more rapidly than the increase in the velocity. Consequently, any increase in the velocity is immediately noticeable in the increased erosive power. The erosive power of the wind is not identical with the carrying power, for in the first case the wind overcomes cohesion, and in the second case it overcomes weight. If the velocity of the wind decreases, the sand previously held in suspension is deposited. Thus if a solid fence is placed upon the sand at right angles to the wind, the sand is excavated in front. The wind, unable to proceed, is divided into currents in all directions. Those going downward scoop out the sand, thus forming a drift a short distance in front. This increases until its height equals that of the fence, when the wind, no longer meeting with the obstruction, allows sand to be deposited in this channel, and it fills up, covering the fence. Similarly, at the ends of the fence the wind currents are increased, and the sand is scooped out. If the fence is raised so as to allow a space beneath, the sand is rapidly scooped out below. The same result occurs beneath buildings, trestles, or other works which allow a space beneath, through which the wind rushes with increased force. If, however, the obstruction is not solid, but more or less open, as a pile of brush or a bunch of grass, the action is entirely different. The wind passes through the obstruction, but with decreased velocity; hence sand is deposited within the obstruction. No excavation takes place in front or around the sides. If the obstruction is stiff and inflexible like a sand fence, the sand is deposited on both sides, the windward slope being gradual and the lee slope more abrupt. If the obstruction is flexible like a bunch of grass, most of the sand is deposited in the lee. Of course, there are all gradations between the two classes, and various circumstances may modify the usual action.

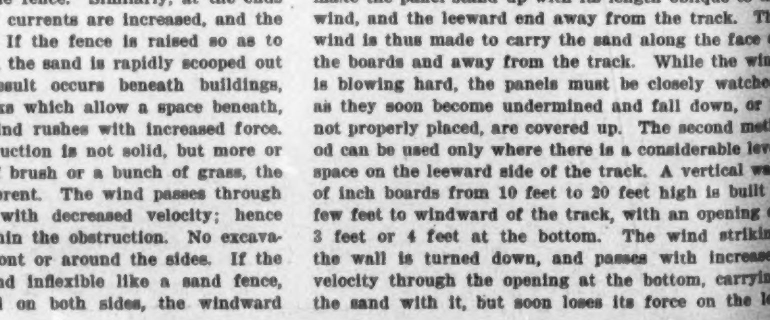
It has also been ascertained, that when the wind is blowing up an incline, the surface velocity increases with the steepness, but when the wind blows down a slope, eddies form, which usually produce a current uphill at the surface. Thus it happens that while small bodies can be blown uphill easily, it is not often that they are blown downhill, but must fall from their own weight when the slope is steep. The fact that the velocity of the wind at the surface on the windward side of a dune increases with the slope results in producing a normal incline, which represents a balancing of forces. Usually this incline is quite gradual compared with the lee side of the dune, where the slope is the greatest at which the sand will remain in place—about 30 deg.

The Columbia River, which deposits the sand along the valley it traverses, often rises to a height of fully 60 feet during the freshet season, carrying down stream an immense quantity of fine silt, which is more mobile than the ordinary sea sand, as it consists of very fine rounded grains, easily combined into drifts by the strong winds which sweep through the valley. The movement of the wave is of course caused by the movement of the sand grains over its crest. As the direction of the winds is generally upstream, the waves have a notable uniformity, and at times attain such a height that actually trees 40 feet in height are sometimes buried to the tops. An analysis of the sand shows that it is very fertile when sufficiently irrigated, but the high winds absorb so much moisture that it is impossible for vegetation to take root in the dry season.

In fighting the sand sea, Mr. J. P. Newell, engineer of the railroad company referred to, has had the assistance of Mr. J. W. Westgate, of the Department of Agriculture, who has made an exhaustive investigation of the conditions. As a result several methods of checking the movement of the sand have been tried, some of them with notable success. The first and most extensively used is the "sand panel." A panel consists of two boards, 1 inch thick by 12 inches wide, and about 20 feet long, nailed to sharp stakes at each end. The stakes are driven into the sand, so as to make the panel stand up with its length oblique to the wind, and the leeward end away from the track. The wind is thus made to carry the sand along the face of the boards and away from the track. While the wind is blowing hard, the panels must be closely watched, as they soon become undermined and fall down, or if not properly placed, are covered up. The second method can be used only where there is a considerable level space on the leeward side of the track. A vertical wall of inch boards from 10 feet to 20 feet high is built a few feet to windward of the track, with an opening of 3 feet or 4 feet at the bottom. The wind striking the wall is turned down, and passes with increased velocity through the opening at the bottom, carrying the sand with it, but soon loses its force on the lee



Wood Breastworks for Fighting the Sand.



Covering Sandhills With Wooden Framework to Prevent Them from Burying a Forest.

SAND WAVES AND THEIR WORK.

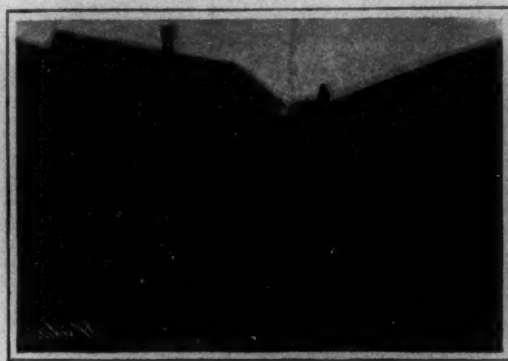
side of the wall, and deposits the sand just across the track. From there it must be occasionally removed by teams or some other means.

A third method, invented by Mr. Newell, is a modification of the panel plan, but is intended to be of permanent construction. A tight wall from 10 feet to 16 feet high, composed of two planes, the upper inclined toward the wind and the lower away from it, is built between the track and the approaching sand drift. The upper plane deflects the air current strongly downward, and the lower one throws it out so it cannot undermine the walls, but is turned against the sand bank. The wind is thus made to carry the sand along the wall to the end, which is located at some point where the natural features will prevent the sand from doing any harm. Such a wall has protected one of the worst places on the road for three years. The movement of the sand has also been partly obstructed by the planting of trees at right angles to the direction of the waves. The trees, which are of a variety which will take root in the formation, are usually set out in two rows separated by a bank of sand, but the formation about them must be artificially moistened to keep them from dying.

As the photographs show, however, there are places where apparently no protection is sufficient to keep the sand from covering the right-of-way. At one point where the track passes close to the wall of rock forming one side of the valley, a force of men and teams is almost constantly employed with shovels and scrapers as illustrated.

As far back as 1832 the people of Massachusetts realized the necessity of preventing the movement of sand dunes near some of the coast towns, to prevent the latter from being literally overwhelmed. The principal form of protection has been the planting of beach grass in places where the wind currents are not too violent to check its growth, keeping the dunes from forming. Some of the dunes have also been "fixed" after formation by planting the grass, then protecting it from the wind by covering the windward side of the hill with brushwood. On a fixed dune certain kinds of trees will grow to maturity. This is illustrated by the forests in New Jersey and Virginia, some of which extend almost to the water's edge. In these States, however, are places where the dunes have reached a height of over 100 feet, and have literally buried growths of large timber to such an extent, that only a few feet of the trees can be seen projecting from the sand here and there.

Near Cape Henry there are shifting dunes, which are gradually engulfing pine woodland in their rear, since this section of the coast is exposed to the severest gales, which sweep over the Atlantic in winter. One of the most notable illustrations of shifting dunes, however, is to be seen at Cape Henlopen, Delaware. Here the lighthouse, one of the highest towers on the seaboard, is nearly surrounded by a ridge of sand, which already reaches more than half way to the top. The resistance to the wind, however, has caused eddies, which have prevented the sand from closing in around the structure, except on one side. From Delaware Bay the size and height of the building can be appreciated, but looking at it from the southeast, from which come the principal winds, the tower appears to be only about 20 or 25 feet above the shore.



House Buried in the Sand Sea.

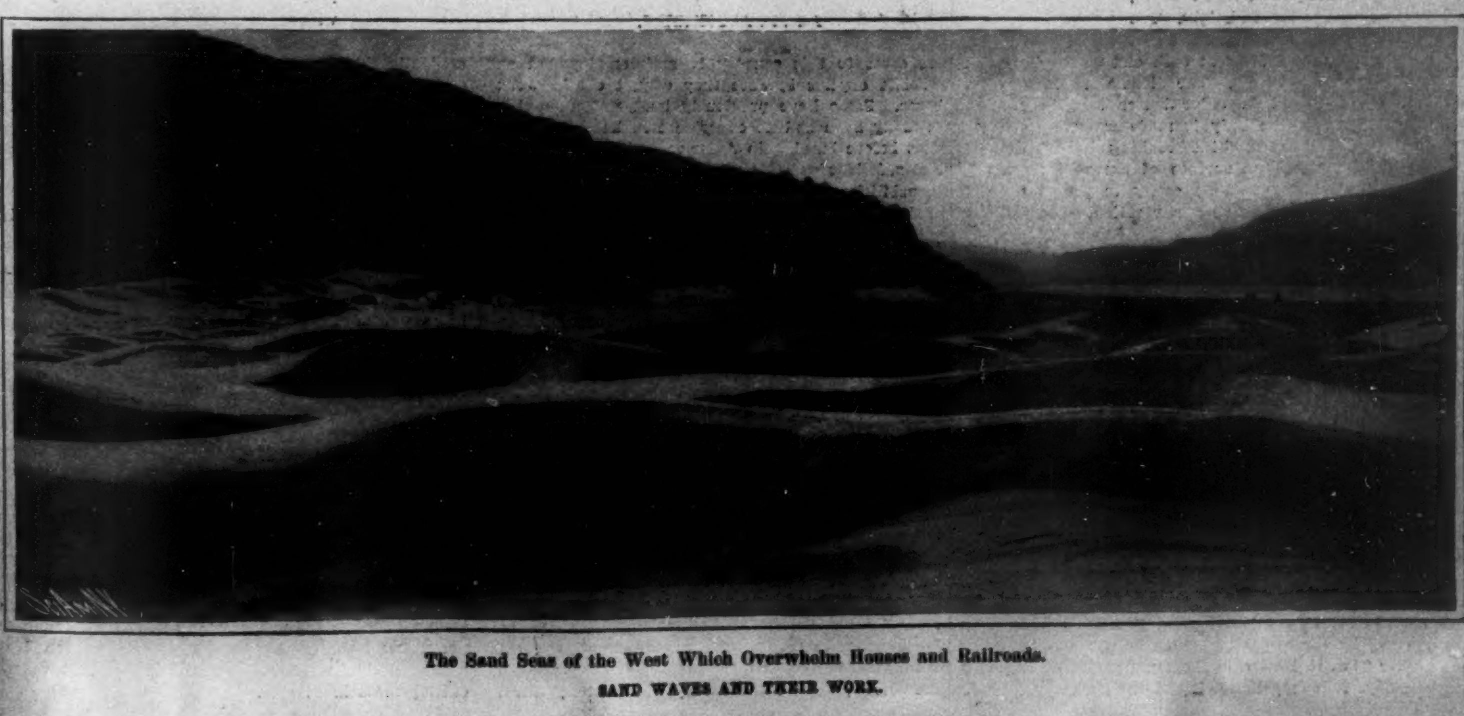
Shifting Dunes Burying a Forest.

Woodland Destroyed by Sand.

Water as a Preservative of Milk.

The rapidity with which microbes increase in certain liquids, and especially in milk, is almost incredible; this is the reason why milk is so difficult to keep. Messrs. Nicolle and Petit, two French scientists, have found that milk, fresh from the cow and taken under test conditions of cleanliness at nine o'clock in the morning, contained one hour later 6,250 microbes per cubic centimeter, 25,000 four hours later, 310,000 after eight hours, and 11,250,000 after a lapse of twenty-four hours. Microbes absolutely swarm in milk after a short time, especially if its temperature be slightly increased. These gentlemen recently examined some samples of milk at Tunis; one of them, which had reached the market at eight o'clock in the morning, was found to contain already 2,387,000 microbes per cubic centimeter. In some instances specimens of the bacterium coli were found. Refrigeration has so far been found to be the only certain means of checking the growth of bacteria, and milk placed in a refrigerator will keep well; in practice, however, this is not within the means of everybody. However, a gentleman, Mons. A. Renard, has now secured highly satisfactory results by means of a very simple method, which is not intended to check the operations of bacteria for very long periods, but merely for two or three days or so. The interesting point about this method is that the milk is left in its natural state, no formol, salicylic acid, borax, or other antiseptic being put into it. M. Renard uses oxygenized water, which decomposes slowly in the liquid without changing it in any way. The experiments were made recently at Rouen, when the inventor of the process merely poured two per cent of water, oxygenized at twelve volumes, into the milk. It is not advisable to use more than three per cent, as the decomposition of the oxygenized water might give rise to certain drawbacks. The milk thus treated did not differ in any way from perfectly fresh milk; when an addition of three per cent was made at a temperature of 11 deg. C., it kept fresh, without the least trace of acidity, for a period of 95 hours, but only for 32 hours when the temperature mentioned was increased to 20 deg. In order to determine whether milk thus treated could be safely given to children, Dr. Debout (of Rouen) experimented with it at one of the dispensaries, giving it to some 57 infants with good results.

Further experiments regarding the preservation of milk have also recently been made by Messrs. G. Nicolle and E. Duclaux, at the Pasteur Institute at Tunis; they have obtained very good results with the refrigeration method, but they are greatly in favor of M. Renard's oxygenized-water process, as its antiseptic action lasts long enough to prevent any alteration in the milk—provided, of course, that it be added directly the milk is drawn from the cow. If added to boiled milk, the oxygenized water, instead of rapidly disappearing, forms certain combinations with the constituents of the milk (which have been altered by boiling) and is only eliminated very slowly. Messrs. Nicolle and Duclaux have carefully studied the effect of oxygenized water upon such pathogenic microbes as the comma bacillus, the bacillus of cholera, bacterium coli, the pyocyanic bacillus, etc., and also upon certain microbes which cause diseases in milk; among these latter we may mention the cyanogenic bacillus which produces the phenomenon of blue milk, and the micro-bacillus prodigiosus, which is one of the chief agents in the putrefaction causing what is termed "red milk." Without going into details, it may be said that oxygenized water does not destroy pathogenic and other germs with certainty—much less the bacillus of tuberculosis, which is the most capable of all in resisting microbicide influences. In this respect the new method does not come up to the pasteurization of milk, which kills all pathogenic microbes, excepting the microbe of tuberculosis; but this latter process does not insure preservation,



The Sand Seas of the West Which Overwhelm Houses and Railroads.

SAND WAVES AND THEIR WORK.

while it changes the properties of the product in such a way as to diminish its nutritive qualities. M. Renard's method of only adding a few drops of oxygenized water is much simpler, and quite as efficient as refrigeration, the milk—without being altered in any way—being kept fresh for at least 30 hours after it is taken from the cow.

AN ICE AUTOMOBILE.

BY G. LUXTON.

The development of the steamship, the locomotive and the automobile, and the still later conception of the dirigible airship, would seem to have exhausted the field of novel means of transportation. Yet a machine which is in its basic principle a decided innovation, has been designed and constructed by a Minneapolis man, Charles E. S. Burch, who has experimented for years in practical demonstration of his idea. The machine in question, illustrated in the accompanying engravings, is now resting on the ice of Lake Calhoun, where it has been tested, for, it must be understood, the machine is intended to travel on a frozen surface. The object which the inventor has had in view is the revolutionizing of the means of winter transportation in Alaska, where he is heavily interested in mining properties difficult to develop because of their inaccessibility. At present, in certain parts of Alaska, freight transportation during the winter is accomplished entirely by dog-teams and sleds, and in consequence the charges are from $100 to $1,000 a ton. It is the inventor's plan to use in place of dog-teams his "ice locomotive" drawing a train of sleds, and in this way to reduce the expense of freighting to a minimum. It is hoped that the invention will prove a boon to winter commerce in Alaska, and should it succeed will doubtless be received with enthusiasm by the thousands in that frozen country, who in winter are practically shut out from the civilized world.

The ice locomotive is propelled by steam engines, but instead of resting on wheels or runners is supported by four great steel spirals, one at each corner of the body, in the places usually occupied by the wheels or runners of ordinary vehicles. The spirals lie with their vertical axes horizontal, and are of opposite pitch. The edges of the blades are fashioned like skate blades in order that they may grip the ice well. Each of the spirals is directly connected to a separate steam engine and consequently the spirals may be operated independently, this method giving unusual control over the car. It can be driven forward, backward, sideways or at any oblique angle desired, and it can even be made to spin around like a top. The model now at Lake Calhoun is 22 feet long, weighs 4½ tons, has engines of 42 horse-power and steel screws 27 inches in diameter. It is easily seen that the greater the diameter of the spirals the greater will be the ability of the ice locomotive to travel over rough surfaces and to surmount obstacles. Accordingly, a machine which the inventor is having built in Canada, to protect patent rights in that country, will have spirals six feet in height. The ice locomotive is steered by means of two semi-circular steel disks at each end of the body operated by compressed air. The disks work in unison and are weighted in order better to grip the ice. The bottom of the body is made watertight so that in the event of the machine breaking through the ice it will float upon the surface of the water. In that case it would be possible easily to propel the machine, for the spiral method of navigation, as is well known, operates successfully.

The Lake Calhoun machine, which is unfinished and rough in appearance, was constructed to make an estimated speed of 9 miles an hour, but on its trial trip it easily traveled at the rate of 13 miles an hour. Obstacles and rough places were passed with surprising ease. A toboggan slide course of ice and snow several feet above the level of the lake ice was surmounted without difficulty while traveling at full speed. The inventor intends to use alcohol boilers in the machines constructed for practical service in Alaska, thus avoiding the danger of the freezing of the boilers, and furthermore, considerably reducing the size of the latter. He plans to have a condenser to condense the alcoholic steam and use it over and over again. Wood, coal, or oil may be used for fuel under the boilers.

The Most Recent of the Ice Automobiles.

One of the Spiral Runners and a Steering Disk.

AN ICE AUTOMOBILE.

A record feat in shipbuilding on the Great Lakes was marked by the recent launching of the 10,000-ton ore carrier "Jos. G. Butler, Jr.," after a period of only fifty-five days following the laying of the keel.

Accidents Due to the Foreign Chauffeur.—The American Coachman is Said to Be More Cautious.

"American coachmen with a little training make more efficient chauffeurs than the majority of Frenchmen out of employment, who come over here with a smattering knowledge of motors and are employed without question as expert drivers of automobiles." This statement was made recently by a gentleman who has owned automobiles for nearly ten years, is prominent in the affairs of the Automobile Club of America, and has had a wide range of experience in the employment of chauffeurs.

"A majority of the fatal automobile accidents that occur in this country," he continued, "are due entirely to the reckless driving or the absolute ignorance of imported chauffeurs. I have no hesitation in saying that the sad accidents that resulted in the deaths of Mrs. Francis Burton Harrison and Mr. James E. Martin were caused by reckless driving. They probably would not have happened had the drivers been graduated from the ranks of coachmen.

"Bursting tires are usually blamed for fatal accidents, but I know that there is nothing about a tire explosion to force a car off its course before being brought to a stop. This was proved by a series of demonstrations given by S. F. Edge in London with tires purposely deflated. A chauffeur naturally will blame an accident to a tire to screen his own recklessness or ignorance.

"Many foreign chauffeurs are capable drivers. Many others come to this country to seek employment as automobile experts because they cannot obtain work at home. Some have previously been waiters and a great many have had no experience in handling automobiles before landing in America.

"Not sufficient effort is made by owners to find out the capabilities of men who apply for jobs as automobile drivers. If an applicant speaks a foreign language he goes a long way toward qualifying for the position. The owner is probably ignorant of the mechanism of his car, and so is unable to question the applicant. He takes it for granted that the latter is all he claims to be, and then intrusts his own life, the lives of his family and those of his friends to a man who possibly knows no more of the machine he is to handle than does his employer.

"In my experience I have found that the most capable and trustworthy driver of an automobile is a man who has been schooled in the driving of horses. The most reliable chauffeur is a good, level-headed coachman. He knows the rules and courtesies of the road; he understands that danger is likely to be met in getting the car off the road; he has a proper respect for the care of the varnish on a vehicle, and if given a little instruction he becomes better able to care for a car, to keep it clean and to turn it out smartly than a so-called expert foreign chauffeur.

"Lessons necessary to evolve a good chauffeur from a good coachman are, first, the theory on which the gas engine works; second the theory of ignition; third, the necessity for perfect lubrication, and, fourth, the danger of fire from gasoline.

"A chauffeur to take care of a car does not need to be a mechanic. If gears are stripped, crank shaft broken or axle bent no chauffeur, however expert, can repair the damage without a machine shop. Therefore it is not necessary to travel with a mechanic, for in case of a serious breakdown the car has to go to a shop anyway.

"If proper care were exercised in the selection of chauffeurs fewer lives would be lost in automobiling. Ignorant foreign drivers, who think more of speed than of saving their cars, slam them over rough roads until they become strained. This may not be noticed until weeks afterward, when, because of the strain, a piece of metal snaps and an accident results.

"Examinations for chauffeurs will not remedy the situation to any great extent. A reckless driver might pass a perfect examination. A revocable license would be more effective, for if a chauffeur finds he is liable to lose the chance of earning his living in driving automobiles, he will be more inclined to exercise care. But to my mind the best solution of the problem is the employment of steady-going coachmen as chauffeurs."—N. Y. Herald.

The Coloring Matter of the Blood.

The properties and composition of the coloring matter of the blood have been investigated by Messrs. Piettre and Vila, of Paris. One of the interesting reactions of toxicology is that which enables us to obtain upon the microscope plate the crystals known as *Teichmann's crystals*, and thus according to this classic experiment we find that the coloring principle of the blood is capable of crystallizing. This remarkable property was studied by different experimenters and was soon applied in blood researches in legal medicine. As it is only a question here of a microscopic reaction, we could not find out the composition of the crystals, but later on Nencki by using the powerful resources at his disposal succeeded in preparing about 500 grammes of this matter, by using enormous quantities of glacial acetic acid. The crystallized substance, which represents the total amount of the ferruginous pigment contained in the blood, he designated by the name of *acethemine*. The process which is used in obtaining it is simple, although expensive, and it gives an excellent yield of fine black crystals having a steel-like luster. The crystals have the form of very long rhombs and can reach a length of 0.12 inch. Microscopic examination shows that the Teichmann crystals which come from a saline solution, and Nencki's compound which comes from the same solution and in an acetic medium, are identical as to form, spectrum and properties. The authors have also prepared a quantity of the body according to Nencki's method. They find about the same analysis which he gave, namely, carbon 62.58, hydrogen 5.14, nitrogen 8.65, chlorine 5.64, iron 8.66. However, they do not consider that it is a definite chemical compound. They wished to produce the crystals which should be free from chlorine, and succeeded in obtaining such crystals, thus finding that the chlorine is not essential, nor is it constant in other cases. The proportion of iron can also vary. The authors are making further researches as to the nature of this body and state at present that there seems no doubt that the crystals in question can be separated into different principles, among which they have already isolated a solid and colorless substance containing no iron.

Certain wooden cylinders, usually from 30 to 50 inches long and from 6 to 7 inches in diameter, have become quite common in some places in Florida. They are called veneer cores, and are the waste lumber from the cutting of material for the sides of orange boxes and for other crates. This veneering, most of which is pine, is cut by clamping the ends of sections of the log to spindles, and revolving the logs rapidly under sharp heavy knives. After the bark is off the knives are sunk into the wood and thin sheets are pared off, unrolling somewhat as paper does from a roll. These are conveyed on runners under drop-knives which fall at regular intervals, and cut the veneer pieces of the right size for the crates. The cores are the heart pieces that are left after all the log that is available for crate material is cut for veneering. These cores are used for various purposes, to some extent for fence posts, but most of them for fuel, and are found at many Florida wood-piles. There are several veneer cutting mills in Florida.

THE INHALATORIUM, A NEW MEDICAL INSTITUTION.

The beneficial results obtained in the treatment of the respiratory organs, nose, pharynx, larynx, and lungs, by the inhalation of certain medicinal substances in vapor form has long been recognized. Until recently there was no apparatus devised that would dissipate the vapors fine enough to permit of their complete permeation into the remote lung air cells. It was not only impossible to penetrate the minute ramifications of the bronchi, but frequently the hot vapors irritated the sensitive mucous membrane, causing more harm than good.

Within a recent period, the well-known German specialist Dr. A. Bulling, of Munich, invented and perfected two forms of apparatus termed the "Guttafer" and "Thermo-Variator," which have been installed in a new medical institute in this city, named "The Inhalatorium," at No. 137 West 122d Street, equipped primarily for the utilization of this improved system of treatment.

Institutions of this character have been successfully established in various prominent cities and localities in Germany, also in London, and are patronized by visiting Americans and others with most satisfactory results.

The accompanying illustrations show the two forms of apparatus; the larger view represents the interior of one of four rooms on an upper floor, each about six or eight feet square, with a slatted wood floor, and located in the center is a large porcelain bowl called the "Guttafer," in which the medicinal preparation to be vaporized is placed. At the base of the bowl are compressed-air supply pipes, which convey the air to the vaporizing pipe and other eight air pipes around it, all projecting upward within the bowl. Through the center tube the air forces upward the liquid in the bowl in a fine vapor, and other jets of air are projected upward through minute orifices in the ends of surrounding tubes. Thus the several upward air jets immediately subdivide the primary jet of vaporized air into innumerable infinitesimal particles of such extreme fineness that they become part of the air, and are readily carried by the natural act of breathing to the most minute ramifications of the bronchi and alveoli of the lungs, reaching the diseased portions at a point heretofore unattainable. The effect of the treatment is to dissolve the mucus collected in the bronchi, and enable the patient to easily expel it in the act of coughing. The patient (protected by a light gossamer cloak to prevent the vaporized air from coming in contact with clothes) usually sits in the chamber half an hour at a time, twice a day, for a period of a few weeks, according to the nature of the disease.

In another sectional illustration, it will be observed that the air compressor, operated by a motor in the cellar, takes in fresh air from the outside through a filter, that it is forced through a heater, adjoining a range in the kitchen, into metallic reservoirs or tanks at a pressure of four atmospheres. From the tanks it is piped upward to four individual chambers on an upper floor.

In the front basement are the smaller portable "Thermo-Variator" inhalers upon tables divided by hanging partitions. The instruments operate without compressed air. The peculiarity of their construction is an adjustable tube on the outside at the back, which will allow more or less air to mix with the vaporized air and vary the temperature to suit different cases. A thermometer located near the mouth-piece registers the temperature of the vaporized air, prior to inhalation. A corner of the room with three of these instruments is shown in another view; the further one is fitted with a nasal piece, held by a rubber tube. The second one, in an upright position, is operated by compressed air, with a special swinging tube for insertion in the nostrils. The nearest one is fitted with a porcelain mouth-piece; this is removable and interchangeable with other instruments, for the purpose of being easily cleaned. The fluid preparation is placed in a metal cup at the rear, and is brought to the vaporizing chamber by capillary attraction.

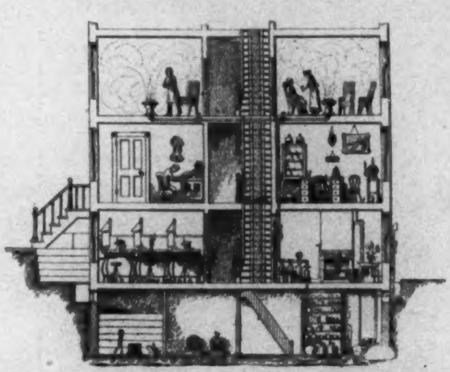
On the first floor are arranged the reception and consultation rooms, equipped with sterilizers and other instruments. All of the floors are carpeted with smooth-rubber sectional carpeting, so that the entire interior is an example of scrupulous cleanliness.

The thoroughness with which the treated air in the rooms enters the remote portions of the lungs was scientifically demonstrated by mixing a dye with the solution to be vaporized; the air was then inhaled by a dog for a brief period; he was next suddenly killed, the lungs removed, and when examined, the color of the dye was found in the extreme portions, showing the circulation of the vapor air here was complete. It is stated that rooms equipped as above are very useful when installed in large factories, theaters, or stock exchanges, for those troubled with hoarseness or throat and chest difficulties, and is particularly valuable in checking the early stages of consumption.

There are also, we are told, in the institution ingenious apparatus for the treatment and possible cure of asthma and apparatus for light therapeutic treatment.

Dr. Johannes Hoving, a specialist who has had much experience with the system abroad, is in charge of the institution.

THERMO INHALING APPARATUS.



INTERIOR ARRANGEMENT OF THE INHALATORIUM.

INHALING CHAMBER IN THE INHALATORIUM.

The Mechanical Equivalent of Combustion.

In a lecture delivered at the recent meeting of the Association of German Naturalists and Physicians Prof. M. Cantor discussed the problem of the mechanical equivalent of combustion and the construction of a rational combustion motor. Combustion processes are known to constitute one of the most important sources of mechanical work. After theoretically defining the mechanical work which can be generated by a given combustion, the author suggests an essentially new process of combustion, by means of which the theoretical limit may be approximated more closely than heretofore. The great practical importance of this discussion need not be emphasized; it is obviously the aim of technical thermo-dynamics to indicate methods whereby a maximum amount of energy can be derived from a given amount of fuel. The theoretical definition of the possible limit is likewise important for the industries, allowing as it does the comparative gaging of results both attained and attainable.

The question of the maximum amount of energy that may be derived from a given combustion process had up to the present been discussed in the following form: What portion of the heat of combustion may be converted into work? Now this implies the idea of a quantity of heat to be converted into work, and this question, as is known, has been answered by Carnot. The qualitative heat values presumed by Carnot, however, are not achieved in reality. What is given is *determined chemical systems by whose conversion work may be produced.* The general problem of technical thermo-dynamics would thus be not a thermo-mechanical, but a chemico-mechanical conversion, and the problem would have to be given the following shape: What amount of work can we derive from a given chemical conversion? In order to solve this problem generally it should be considered that chemical conversions are usually attended by an expenditure of work and the evolution of heat, the latter possessing a working power determined by the Carnot theorem. Only the sum total of the work immediately yielded and possible of derivation from the transformation of this heat will give the total amount of work that can be derived from the chemical change. For this amount may be given a general expression depending only on the initial and terminal conditions of the system that is converted, i. e., being independent of the manner of conversion. This will give the upper limit of the greatest possible amount of work that can be obtained and this is what the author defines *mechanical equivalent of chemical conversion.* The ratio of the work yielded by a motor to the mechanical equivalent of the chemical process occurring in the motor is the *rational efficiency* of the motor. Applying the theoretical results to the usual types of engine where mechanical work is expended by the alteration in the volumes of given amounts of gases or vapors, the amount of work which can be obtained from a combustion will be found to be determined mainly by the ratio of the terminal to the initial volume of the gaseous masses. The smaller that the latter, particularly, can be made, the higher will be the efficiency. Drawing the necessary consequences from the result, it is imperative that the combination of the reacting substances, viz., oxygen on one hand and fuel on the other, be confined to a volume as small as possible.

This postulate now leads to a novel working process where the oxygen is used not in the *gaseous condition*, but in physical or chemical combinations, i. e., in the shape of oxides. The author suggests a practical design where liquid fuels, as petroleum, are forced into incandescent copper oxide in such a way that the gases of combustion produced by burning of the oxide with the oxygen assume the smallest possible initial volume. The reduced metallic copper is then reconverted into the oxide by the oxygen of an air current blown through it, and thus the oxygen is reduced to a volume about 7,000 times smaller than that which it had in the air, while the oxidation may be utilized for a further production of work. A diagram exhibited by Prof. Cantor strikingly shows the superiority of this novel working process, and it is believed that when properly developed by engineers, it may lead to important practical results.

Watering the Streets with Sea Water.—There are now a large number of cities on the seacoast which have recourse to salt water for watering the public thoroughfares, esteeming it a veritable waste to make use of fresh water for this purpose. They are the more satisfied because the hydroscopic properties of sea water avoid the necessity of frequent applications. On the other hand, salt water exerts a very destructive influence on the paint and varnish of vehicles, and merchants affirm that the salt is found everywhere, and that its deliquescence is attended with harmful results. And again, salt water is destructive to the pipes and metallic fittings, and the leakage of the pipes will kill vegetation in streets, parks, and gardens.—La Nature.

TRAINING WALL.

A recent invention of Mr. D. G. Ambler, of Jacksonville, Fla., has for its object the protection of piling from the ravages of the teredo worm, and it should be found very useful in southern rivers and harbors for training the course of currents. In the South Atlantic and Gulf States there are no ice fields to contend with, nor are there very heavy tidal or river currents, which would involve the necessity of using a heavy mass of stone to resist the great force exerted by them. Yet, owing to the teredo, it has been found impracticable to use wooden piling, and of late years reliance has been placed on dredging, which, though temporary in its results and quite expensive, has been considered cheaper than training walls built of yellow pine, as formerly. The present invention, however, provides a means for protecting the yellow pine pile, thus cheapening the training wall and making it permanent. This protection consists in surrounding the pile with terra cotta pipe sections fitted together, as illustrated, and leaving an annular space of a couple of inches between the wood and pipe. Before driving the pile the surface of the wood near the water line has headed nails driven into it every few inches, leaving the heads projecting, say, one inch. The space between the wood and the pipe is filled with Portland cement concrete. The concrete when set not only keeps out the worm, but, owing to its hold on the nails, cannot be detached by cracking in case of being struck by floating objects, such as lighters, vessels, or logs. To further provide against peeling of the pile piping or the concrete, the interior surface of the piping is formed with dovetail-shaped grooves, as shown in the sectional view, Fig. 2. Fig. 3 illustrates the method of forming the training wall with this protected piling. To prevent the ingress of the worm from below, growing out of scour, an ample riprap of stones and dead oyster shells is provided. The piles are driven very close to each other, producing a perpendicular stone wall proof against any attack of the worm, or from decay. We are informed that the power of these piles to resist any injurious stress has recently been certified by the Forestry Department of the Government as based on tests made by it.

TRAINING WALL.

The Human Body as a Power Generator.

Some interesting data are contained in a recent issue of the Revue de Chimie Industrielle. According to researches of Prof. Fischer, the amount of heat given off by the food absorbed by a grown man and stored each day would be about 3,000 to 3,500 kilogramme-calories. The larger part of this amount is utilized in the body, for respiration, digestion, and for the various functions of animal activity, while about 300 kilogramme-calories are spent during a working day of eight hours for continuous mechanical work equivalent to 127,000 kilogramme-meters. As each horse-power hour is equal to 270,000 kilogramme-meters, the daily work of a grown man would be about 0.47 horse-power hour.

Under the above conditions the author calculates the cost-price of 100 horse-power in the case of man, of horses, and of machines. 250 workmen at 3 francs per day being necessary to yield this amount of work, the cost will be 750 francs in the case of human work; 10 horses doing the same amount of work, the expense will be 60 francs; while a gas engine involves a cost of 6 francs, and a gas motor of 3.50 francs. Hence the author concludes that the human motive force is a hundred times more expensive than mechanical energy.

COMBINATION CHAIR AND LIFE PRESERVER.

In the accompanying engraving we illustrate a novel chair adapted for use on pleasure boats and passenger steamers. The chair is of the ordinary folding camp-chair type, consisting of two parts hinged together, and on which the seat is supported. The back of the chair is hollow, forming a receptacle for a life preserver of the common cork type. The receptacle is closed by a lid, which provides a water-tight covering. Recent disasters have proved that cork life preservers must not be exposed to the weather, or they will soon rot and lose their efficiency; also, that they must not be packed away on the ceilings or other remote parts of the boat, where they are difficult of access. Both of these conditions are met in the present invention, for the life preservers are kept perfectly dry in the receptacles, and yet are ready for instant use in case of emergency. But the chair offers still another advantage, namely, that whether the life preserver be removed or not, the chair can be used as a life-raft, so that the shipwrecked passenger need not worry about the proper adjustment of his life preserver, but may cling to his chair for support. The chair is made in accordance with the United States steamboat inspection laws regarding life-rafts of this type, so that a steamer provided with these chairs would not have to be equipped with the usual bulky life-rafts now required. Thus every chair will be a life-raft, and every life-raft could be used as a chair, instead of uselessly occupying valuable storage space. The inventor of this life-preserving chair is Mr. George Fentrick, 141 West Sixty-third Street, New York, N. Y.

COMBINATION CHAIR AND LIFE PRESERVER.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

GATE.—I. R. Burkholder, Dayton, Ohio. The invention relates particularly to driveway gates opened at one side from a vehicle and closed in like manner at the opposite side after having passed through the gateway. One purpose is to provide a special construction of hinge, through the medium of which and its connected chains and cables the gate may be freed from its latch and easily and conveniently swung to open position and returned to closed position.

DITCHING-PLOW. — J. F. Mikolasek, Vodnany, S. D. In this patent the invention has reference to improvements in ditching-plows, the object being to provide a device of this character that will be simple in construction, adjustable as to the depth of cut, and so arranged as to discharge the dirt to one side of the ditch.

Of General Interest.

BUTTON-HOLDER.—A. M. Hill, Rockville Center, N. Y. The object in this improvement is to provide a holder more especially designed for engaging the base or back of the front collar-button of a shirt to project the outer end of the collar-button forward to permit the wearer to conveniently button the collar to the collar-button without requiring much physical exertion on the part of the wearer.

SPATULA AND CORK-EXTRACTOR.—E. B. Jelks, Quitman, Ga. The blade has its intermediate portion between the spatula and extractor of width to project slightly beyond opposite sides of the handle-sections. These projecting sides of blade are milled or roughened, so that the operator grasping the handle also grasps the blade to hold it rigid between the sections, so he can quickly adjust the blade from one position to the other by having screws slightly loose so it is not necessary to tighten or release the screws each operation, as the grasp tightens the sections upon the blade and the gripping of the blade's edges secures parts rigidly together.

DREDGE.—A. J. Burcham, Kelso, Wash. The invention is an improved dredger and scraper adapted to be operated on land or from a float on water, for use in deepening or widening river-beds or opening canals, building levees, or working river-beds in placer-mining, and for other allied purposes. Performance of work is very large, from the fact that the two diggers and scrapers operate simultaneously.

DEVELOPING-MACHINE.—W. M. Towers and H. S. Harrington, Rome, Ga. In the present patent the invention is an improvement in machines for developing and fixing photographic films. The operation of developing or fixing is determined by lapse of time and not by sight. The improvement while simple in construction is yet efficient in operation, the development and fixation being uniform throughout the length of the film.

FOLDING CANOPY.—J. A. Poltock, East Rutherford, N. J. This canopy or awning is designed more especially for use on pleasure-boats, platforms, stands, etc., and is arranged to permit convenient and quick setting up for use or folding into small space when not in use or when making landings, going under low bridges, and the like, to allow applying to a desired angle for obtaining proper shelter from the rays of the sun or from rain, and permitting convenient egress or ingress without taking the canopy down.

SAW-SET.—P. A. Gianera, Gualala, Cal. In this case the invention relates to a means for setting the cutting-teeth of drag or cross-cut saws. The object of the invention is to provide a device adapted to saws of all sizes and by means of which the teeth may be readily set at any desired angle.

LAP-ROBE.—L. S. Stroock, New York, N. Y. This improvement is capable of general use but is especially designed for application to robes in carriages and other vehicles. The hands of the user may be protected from cold without making any opening through the robe through which air can penetrate. A further object is to provide a receptacle for the hands, so placed in the robe as to permit the user to insert the hands and at the same time use his hands to aid in keeping the robe in proper position, this being accomplished with such a construction that the robe is held close to the body and no passages provided between the robe and the body for the arms.

VALVE.—H. W. Beach, Montrose, Pa. The essential object of the invention is to provide a valve of the puppet type, which in the event of the fracture of the valve-stem will not fall into the chamber with which it communicates, the arrangement being such that the valve will be held approximately to its seat notwithstanding fracture of the stem. It relates particularly to valves for internal-combustion engines, but is useful in connection with other machinery.

BLOCK.—W. F. Roberts, Nashville, Tenn. This improvement refers to blocks used in connection with tackle, and more particularly to those adapted for the tightening of conductors and carrier or guy wires in line construction. The principal objects are the provision of a block which is automatically locked upon the establishment of a definite tension in the wire to which it is applied, this being capable of variation, and which will give an indication of the existence of the lock.

Heating and Lighting.

FLUE-CLEANER FOR STOVES AND RANGES.—W. Jaques, Royersford, Pa. In the present patent the object of the invention is the provision of a novel simple device that affords convenient means for cleaning soot and fine ashes from the horizontal flue below the oven-bottom wall in a stove or range.

CRUDE-OIL BURNER.—S. E. McKnight, Iola, Kan. The invention relates to improvements in burners for crude oil of any grade or description, the object being to provide a burner so constructed as to issue an intense heat with an economical use of oil, as practically all the products of the oil will be volatilized and burned clear of smoke.

Household Utilities.

WATER-CLOSET. — F. Schuh, Albany, N. Y. When the seat is moved downward the ball-valve will engage in the seat and the water from the pressure-pipe will pass through the branch-pipe into a chamber, compressing air against its upper wall. When seat is raised or relieved of pressure, a spring forces the lever downward, consequently elevating the seat, and seats the ball-valve on the valve-seat, cutting off the water inflow, and then the compressed air in the chamber will force the water out of said chamber upward through a pipe onto a flange and thence into the hopper.

Machines and Mechanical Devices.

SHUTTLE HOLDER AND DRIVER FOR SEWING-MACHINES.—P. J. Hanley, Elizabeth, N. J. The invention pertains to improvements in sewing-machine shuttle holders and drivers of the type having an oscillating movement, the object being to provide a means for holding the shuttle in position, doing away with the usual shuttle-race, and thereby obviating friction incident to a shuttle operating in a race of the ordinary construction.

TYPE-CLEANING DEVICE FOR TYPE-WRITING MACHINES.—S. E. Halsey, Everett, Wash. The invention relates to type-cleaning devices for type-writing machines, its object being to provide a simple, cheap, and efficient device of the character specified and one which can be readily attached to or detached from a type-writing machine and also secured to the frame of the machine when not in use.

FRICTION-CLUTCH AND GOVERNOR.—C. Christiansen, Crookston, Minn. The invention is intended especially for use in connection with band-cutters and feeders for threshing-machines. The object is to produce a powerful and sensitive clutch which will act as a governor, serving to connect and actuate the feeder and band-cutter as soon as the threshing-machine has obtained sufficient speed to operate efficiently.

BRICK-MACHINE.—O. Nolan, Minneapolis, Minn. In operation of this improvement in brick-machines the material is placed in the molds and tamped therein. A board is then laid across the tops of the molds, the ends of the boards resting upon handles for convenience in turning the frame upon its hinges. The swinging frame is then turned backward with the board, and since the position of the brick is reversed the board will be underneath, and when the bottoms are turned back into position the brick will remain upon the board.

Prime Movers and Their Accessories.

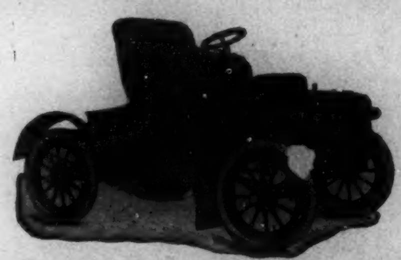
VAPORIZER.—C. Hibbard and W. Hibbard, Sandyhill, N. Y. The invention pertains to explosion-engines; and its object is to provide a vaporizer or mixing-valve arranged to insure a quick and complete vaporization of the liquid fuel (gasolene) and an intimate mixture of the proper amount of air and vapor and to prevent flooding of the device by the liquid fuel and frosting of the liquid-fuel chamber in cold weather.

Railways and Their Accessories.

CAR-COUPLING.—J. Rooney, New York, N. Y. In the present patent the invention has reference to improvements in car-couplings, the inventor's object being the provision of a coupling of simple and novel construction and so arranged as to automatically couple when two coupling-heads are brought together.

RAILWAY-TRACK GAGE AND BRACE.—J. H. Crowley, Duluth, Minn. The invention relates to improvements in gage bars and braces for railway-rails, the object being to provide devices of this character that will be simple in construction, easily placed in position, and comprising comparatively little metal, thus causing a saving in expense.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



Model K, 10 h. p. Runabout, $750, f. o. b. Detroit
(not including lamps)

Model M, Light Touring Car, $950, f. o. b. Detroit
(not including lamps)

The New CADILLAC Models

It is *concentration of effort* that has made the Cadillac what it is. For five years its makers—the master designers and motor builders of America—have focused their endeavors upon a single object—to produce a faultless motor car. A consummation of these efforts is found in the magnificent new cars for 1906, a line so complete that it offers a machine to suit any purse, to answer any requirement. The smaller models out-distance by far any cars of their class, no matter what their cost, while the larger models embody every point of excellence thus far found in most expensive touring cars, either of American or foreign make. When you remember the remarkable efficiency of the famous Cadillac single-cylinder engine, and consider this same principle embodied in quadruple form, you will gain a slight idea of the serviceableness of the four-cylinder models of the

CADILLAC

Among their many improvements is an automatic governor which limits the speed of the engine when the latter is disconnected, eliminating vibration and saving much fuel and energy. Another is the mechanically-operated oil-feed (found on all Cadillac models) which supplies oil to the engine in accordance with its speed, keeping it always in a state of perfect lubrication. The transmission in all models is of our exclusive planetary type, with specially cut and hardened gears.

Because of their elegance of design and finish, the new Cadillacs aroused even more than usual enthusiasm at the New York and Chicago Shows. They are of striking beauty and luxurious appointment. Wheel base of Model H (30 h. p.), 100 inches; Model L (40 h. p.), 110 inches.

Let us send you our finely illustrated catalogue N, also address of nearest dealer. He will show you all models; he will give you a demonstration, and the severer it is the more will the true worth and dependability of the Cadillac assert themselves.

Model K, 10 h. p. Runabout, $750.	Model H, 30 h. p. Touring Car, $2,500.	Model L, 40 h. p. Touring Car, $3,750.	All prices
Model M, Light Touring Car, $950.	Model H, Coupe, $3,000.	Model L, Limousine, $5,000.	f. o. b. Detroit.

CADILLAC MOTOR CAR CO., Detroit, Mich.

Member Asso. Licensed Auto. Mfrs.

Model H, 30 h. p. Touring Car, $2,500, f. o. b. Detroit
(not including lamps)

Model L, 40 h. p. Touring Car, $3,750, f. o. b. Detroit
(not including lamps)

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.** MUNN & CO.

Marine Iron Works, Chicago. Catalogue free.

Inquiry No. 7893.—Wanted, an electric wood flour sifter.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7894.—For manufacturers of a device for indicating steam engines known as the Schultz Manograph.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7895.—Wanted, modern machinery for opening large slate quarries where from 10 feet to 30 feet of stripping is to be removed; material, dirt and slate to be carried ¼ mile.

WANTED.—Partner for new invented current motor. Must furnish capital. Address Partner, Box 773, N. Y.

Inquiry No. 7896.—Wanted, channeling machinery, for use in slate quarries; enameling ovens, to enamel slate slabs; electric, hand, portable drilling machines; also air drills.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7897.—Wanted, makers of bottling machinery for soda and mineral waters.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 7898.—Wanted, makers of patent railroad spikes or similar devices for fastening rails to ties.

Fine Lithographed Letter Heads, Bill Heads, Envelopes and Checks, given standing. Stilwell, 709 Pine St., St. Louis.

Inquiry No. 7899.—Wanted, a flexible shaft fitted with sand paper disk or cutter, for cleaning hulls of row-boats and motor launches.

WANTED.—To arrange with manufacturer for introduction of new bicycle. References. R. M. F., 2905 Strand, Galveston, Tex.

Inquiry No. 7900.—For manufacturers of pillow or feather ventilators.

FOR SALE.—Self-swinging gate, great improvement. Sell or lease on royalty. Patented November 21, 1905. Claude Siebring, George, Iowa.

Inquiry No. 7901.—Wanted, the name and address of the manufacturers of "reap hooks."

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods, Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

Inquiry No. 7902.—Wanted, manufacturers of Franklin metal.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7903.—Wanted, a small press for extracting oil from nuts.

WANTED.—To secure a party to manufacture a patent Ratchet Drill. Address Drill, Box 773, New York.

Inquiry No. 7904.—Wanted, the name and address of the manufacturer of the white metal finished casting, which requires no filing or other finishing.

Bates & Peard furnace for bright annealing all nonferrous metals. Without oxidation. No pickling or cleaning required. C. M. Daily, Agent, 39 Broadway, New York.

Inquiry No. 7905.—For manufacturers of magnets suitable for water meters.

Inquiry No. 7906.—For manufacturers of small turbines, such as the Francis or Gonval type.

Inquiry No. 7907.—For parties engaged in installing appliances for consuming oil for fuel under boilers.

Inquiry No. 7908.—Wanted, small wood grooved pulleys ¾ inch diameter by ¼ inch wide; also non-elastic fancy cord ⅛ or ¼ inch diameter.

Inquiry No. 7909.—Wanted, makers of flour mill machinery.

Inquiry No. 7910.—Wanted, complete mints for copper and silver coins in different sizes.

Inquiry No. 7911.—Wanted, double shears to cut ¼ to 1¼-inch boiler plates, with and without steam power, also one shear on one side and a punch on the other.

Inquiry No. 7912.—Wanted, cotton-spinning machinery for hand, foot and steam power.

NEW BOOKS, ETC.

FORTY YEARS AN ADVERTISING AGENT. 1865-1905. By George Presbury Rowell. New York: Printers' Ink Publishing Company, 1906. 12mo.; pp. 517. Price, $2.

Mr. George P. Rowell is the dean of advertising agents, and his work has left an indelible impress upon the great business of publicity. During a long and diversified life, Mr. Rowell has seen vast agencies grow up from a single desk in a tiny office. While the earlier agents handled hundreds, the great agents of to-day handle appropriations which sometimes amount to a million dollars annually. The whole history of the advertising field is admirably portrayed in the fifty-two chapters, or papers, which make up the contents of this volume, which is illustrated with a number of interesting portraits and groups. The book will prove of great interest, even to those who are not especially interested in advertising proper. Some of the reminiscences are most interesting.

HOW TO MIX PAINTS. By G. Godfrey. Chicago: Press of the Western Painter, 1905. 12mo.; pp. 72. Price, 50 cents.

This is a practical treatise prepared for the needs of the practical painter. It is intended to aid the painter in mixing his colors when he desires to match a given shade. Chapter X on "Color Harmony" contains much that is helpful to the house painter and decorator.

DIAGNOSIS OF THE EYE. By Henry Edward Lane, M.D. Chicago: Cosmos Publishing Company, 1906. 8vo.; pp. 156. Price, $2.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9890) C. V. asks: In a dry room, more especially during the winter season on account of the drier atmosphere indoors, a person can electrify himself by shuffling in his shoes over the carpet. While doing this, if he hold his hand flat on a piece of paper placed against the wall, the paper will be found to adhere (or be attracted to) the wall, even for a few seconds after the hand has been removed from contact with it. This is, of course, an experiment, but what does actually take place, and how is the attraction of the paper to wall electrically explained? I understand the body gets charged positively (or overcharged) by the shuffling of feet on the carpet. Would then the paper, becoming positively electrified by contact with the hand, decompose by induction the neutral (electrical) state of the wall, and by attracting inductively the negative of the latter to itself, thus explain its adherence to the wall? Or does the paper only act here as a dielectric (or non-conductor between two attracting surfaces), thus explaining again the temporary adherence to the wall? Can you offer in a concise, yet detailed way, the real explanation for this adherence? A. The sticking of a piece of paper to a wall by an electrified hand pressing against it is due to electrical induction. The paper is a dielectric, the hand has a certain charge, perhaps positive on one side of the paper, and the other side of the paper becomes negative by induction and the surface of the wall is made positive, thus attracting the paper to itself.

(9891) A. W. B. asks: I write for a bit of information in regard to the Northern Lights. Have not seen them for years. They were always so bright in spring and fall, but as I say, have not seen them for years. I was inquiring of different ones around here, and they seem to know nothing about them, and so I was advised to write to you. A. We are not aware that there is any difference in the frequency of the Aurora from year to year, excepting as the sunspot period possibly may influence their numbers. If you will address an inquiry to the Weather Bureau, Washington, D. C., the observers there will doubtless be able to give you the figures on the subject, since records of the Aurora are usually kept as a part of the regular observations of the Bureau.

(9892) F. A. asks concerning a spring which broke while immersed in hydrochloric acid in order to clean it of rust. A. There is no probable connection between the action of the acid and the breaking of a spring, unless the spring has been in the acid for a very long time, in which case the acid would be destroyed, and the liquid would be a solution of chloride of iron in water. This would rust the iron by forming oxide of iron. Hydrochloric acid has only a slow action upon iron, and loses its acid qualities by contact with iron. It is impossible to break a spring by simple contact with an acid. Why then did the spring break? If you will refer to Kent's "Engineer's Pocket Book," page 238, Relation of Elastic Limit to Endurance under Repeated Stresses, and on page 240, Resistance of Metals to Repeated Shocks, the true explanation will be found. A bar of metal will break by the repeated application of a stress much below the breaking strength of the metal. Thus a bar of steel which would hold 49 tons per square inch broke by the application of 28.6 tons per square inch without shock for 170,000 times. The same result follows repeated shocks to a metal. Thus the firing of a gun will finally burst the gun, although the gun easily withstood the pressure at first. The bending of a spring is a similar case to the repeated application and removal of a weight. By and by the spring breaks. The spring in your case had been used for fifteen years, under strain all the time. It is not necessary to suppose any occult power of an acid, which it does not possess, to see why the spring broke.

(9893) A. M. G. asks: Please state in Notes and Queries column the number of vibrations per second for each note of the octave in the natural key from middle C of an organ or piano, for the first octave both above and below the middle C, at the recognized standard pitch as used in this country. A. The International Standard Pitch is for A above middle C, 435 vibrations a second. This gives for that octave of a piano or organ by the method of Equal Temperament, which is in universal use, C, 258.6; C sharp, 274.0; D, 290.3; D sharp, 307.5; E, 325.8; F, 345.2; F sharp, 365.8; G, 387.5; G sharp, 410.6; A, 435; A sharp, 460.9; B, 488.3; C, [illegible]. For the octave below middle C, divide these numbers by 2. All octaves up and down are found by multiplying successively by 2 for upper octaves and dividing by 2 for lower octaves. Any octave has twice as many vibrations as the notes of the octave next below it had.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

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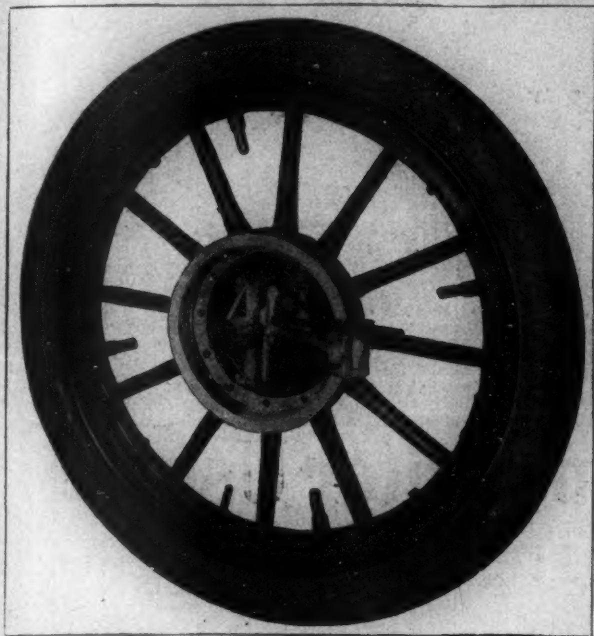
Baling press, D. D. Stanbro	812,696
Baling press, hay, D. S. Edenfield	812,332
Band cutter, Clay & Reeves	812,784
Battery grids, machine for making, W. F. Richards	812,295
Beam presser, H. Parsons	812,290
Bearing, Lea & Degen	812,756
Bedsteads, mosquito net frame attachment for, W. K. McCardell	812,284
Bending machine, automatic, L. H. Brinkman	812,258
Bicycle support, G. F. Cook	812,547
Bin. See Tilting bin.	
Binder, C. L. Donohoe	812,731
Binder for loose leaves of books, J. P. Boehner	812,397
Biscuit packing machine, A. Magnan	812,221
Bit brace, J. Gessert	812,198
Blast combustion, B. E. Eldred	812,193
Boiler, W. N. Rumely	812,529
Boiler supporting lug, C. S. Hooper	812,492
Bolt clipper and punch, J. L. Painter	812,225
Book and job chase, O. Howard	812,425
Book back, loose leaf, Schultz & Gerding	812,602
Boom for steam-shovels and the like, composite, W. Ferris	812,204
Boring apparatus, deep, W. Wlodarczyk	812,541
Boot and shoe, S. Wilde	812,443
Bottle cap lifter, A. C. Booth	812,257
Bottle, non-refillable, C. E. Carroll	812,724
Bottle, non-refillable, Knollenberg & Frey	812,751
Bottles by means of metal capsules, apparatus for closing, E. Goltstein	812,648
Bowling alley pin spotter, C. L. Bastian	812,253
Bowling ball handle attachment, S. H., H. O., & S. H. Law, Jr.	812,214
Box and target, combined, P. R. Warren	812,536
Box fastener, H. Stotz	812,308
Brake, S. H. Libby	812,758
Bronzing machine, L. Haenlein	812,562
Broom handle, T. I. Swagerty	812,309
Brush and comb, combined hair, A. McKenzie	812,766
Buckle, lock, J. Shaw	812,372
Building block, F. M. Sawyer	812,369
Building block, J. A. Johnson	812,498
Building block, W. D. Moore	812,667
Building construction, J. S. Culley	812,727
Burglar alarm, F. C. Harriman	812,420
Butter press, F. Murphy	812,439
Can body machine, locked seam, J. H. McElroy	812,285
Can opener, C. Cochran	812,406
Can testing machine, C. B. McDonald	812,224
Canceling and postmarking machines, feed mechanism for stamp, F. Bjurstrom	812,780
Canceling and postmarking machines, ink-apparatus for stamp, F. Bjurstrom	812,255
Candle holder, L. M. Wilde	812,248
Car bodies, center stem guide for, B. S. Brown	812,720
Car coupling, automatic, D. M. Wilson	812,540
Car couplings, operating mechanism for automatic, E. E. Turney	812,386
Car door operating mechanism, A. Campbell	812,783
Car draft rigging mechanism, B. S. Brown	812,721
Car, dump, S. Otis	812,350
Car fender, J. Landau, Jr.	812,571
Car replacer, J. M. Scudder	812,302
Carburetter, hydrocarbon engine, W. Kouns	812,753
Carpet stretcher, E. S. Carothers	812,405
Carriage body corner construction, J. P. Johnson	812,207
Carriage, child's, M. & C. R. Piercy	812,447
Carriage, child's folding, W. H. Barker	812,323
Carriage curtain fastener, L. J. Luckhaupt	812,661
Casing spear, trip, W. H. Kesselman	812,569
Cement block machines, core cutter for, J. W. Stuart	812,702
Cement block molding machine, R. E. Teets	812,615
Cement fence post molding machine, B. H. McMillan, et al	812,767
Cement kiln heat recuperator, C. Ellis	812,786
Chair legs for rockers, machine for shaping, H. L. Staley	812,461
Chandelier, extension gas, Cotton & Moor	812,549
Cheese cutter, computing, Louiso & Hensley	812,280
Churn, J. W. Dowden	812,190
Churn, W. L. Pool	812,592
Churn cover, J. C. Hogue	812,506
Churns, pumps, etc., motor for, J. H. Skinner	812,450
Clamp, J. J. Stevens	812,690
Clay bin emptying apparatus, C. W. Raymond	812,230
Clay products, system and means for drying and burning, R. W. Lyle	812,509
Clock and money box, coin controlled, H. Gillier	812,200
Closet bowl seat, Bryant & Allen	812,480
Clothes line support, Miethke & Mach	812,583
Clothes marking apparatus, Caldwell & Sorenson	812,723
Clutch, I. H. Spencer	812,694
Coffee roasting machine, F. T. Holmes	812,208
Coin controlled apparatus, F. J. Dole	812,331
Coin sorting or separating apparatus, B. Cranner	812,327
Coins and the like, apparatus for delivering or counting, Weinreb & Rabinowitch	812,624
Coke drawing machine, D. A. Ramage	812,364
Collar for draft animals, F. Leinen	812,430
Comb, C. M. Shubert	812,241
Combing and drawing machine, Crepy & Freinaux	812,550
Comminuting machine, Iveson & Wilson	812,749
Compass, beam, T. N. Badger	812,322
Concrete block forming machine, E. C. Glatfelter	812,336
Concrete building block press, J. A. Ferguson	812,416
Concrete pile, pillar, etc., G. L. Mouchel	812,223
Concrete wall mold, J. L. Richardson	812,365
Contact system, surface, F. E. Case	812,725
Conveyer, G. I. Biems	812,319
Conveyer, C. W. Levalley	812,757
Conveyers, roller chain for, A. Johnson	812,655
Cooker, Henderson & Weiss	812,564
Cooking utensil, J. F. Ferry, reissue	12,452
Core making machine, C. A. Smith	812,606

No Automobile is Safe Without a Back Stop

Many lives have been lost by Backing Down Hill



ALL experienced Automobilists are aware of the dangers and inconvenience of stopping and starting cars on an up grade, with the ordinary brakes now in use. The injury to machinery caused by throwing the clutch in too soon, in starting, and the danger of running backwards down hill, should the brakes be released too soon, makes the Hayden Automatic Back Stop an absolute necessity on every up-to-date car.

The method now used of getting out and placing a stone under the back wheel is an extremely disagreeable operation. All the dangers and difficulties above mentioned are overcome by the use of the **Hayden Back Stop** which acts automatically, instantaneously, and is noiseless.

The **Hayden Back Stop** is preferably placed on the front wheel of a motor car, as shown in cut, where it is more easily applied at a moderate expense and can be adjusted to any cars now in use, with a slight change in construction.

This device is controlled from the seat of the motor car. The position of the Toggle in respect to the band is such, that when the wheel rotates in a forward direction the Toggle will not arrest such movement in any manner; but, if the wheel attempts to move in a reverse direction the Toggle will prevent the movement thereof instantaneously.

It will be evident from the foregoing construction if a vehicle is going up grade, and is stopped thereon, the vehicle will be automatically prevented from backing down hill.

This device with the accompanying description, is intended to call the attention of motor car manufacturers. For factory rights, and for further information, address,

"HAYDEN AUTOMATIC AND EQUIPMENT COMPANY," 26 Cortlandt Street, NEW YORK

Railways, take-up device for overhead cable, J. G. Walls 812,621
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Riveting machine, pneumatic, J. H. French. 812,787
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Rock drill, C. J. Smith 812,375, 812,774
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Rotary engine, F. Egersdorfer 812,414
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Saw mill, gang, W. M. Wilkin 812,539
Scaffold board, extensible, C. Schwedt 812,301
Scale, mechanical recording, E. McGarvey. 812,286
Scale, price, O. O. Ozias 812,289
Screw, temper, C. W. Fanton 812,487
Scrubbing machine for removing foreign matter from the surfaces of globular objects, A. Taplin 812,406
Sealing machine, envelop, Fancher & Parslee 812,203
Separator, H. M. Hardgrove 812,340
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Sewing and cutting machine, J. Diehl 812,409
Sewing machine, Corcoran & Dobyne 812,641
Sewing machine rotary loop taker, Dimond & Dial 812,410
Sewing machine tuck guide, S. Friedman .. 812,558
Shade bracket, window, A. B. Dunkle 812,202
Shade fixture, S. L. Skinner 812,242
Sharpening rock drilling machine bits, apparatus for, J. A. G. Kirsten 812,570
Sheave, W. C. Fischer 812,488
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Ships' hulls, construction of, J. B. I. A. Julhe 812,656
Shock compressor, J. M. Schebler 812,297
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Show case, A. W. Zeigler 812,713
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Smelting and converting ores, A. M. Day .. 812,785
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Steering submarine and submergible boats, means for, L. Y. Spear 812,306
Sterilizing liquid by heat under pressure, apparatus for, C. F. V. Morel 812,765
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Target, T. J. McNelly 812,580
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Tea kettle, H. B. Rohde 812,456
Teaching spherics, educational device for, R. B. Dickerson 812,408
Telegraph instrument, C. J. Schwarze 812,773
Telegraph key, W. O. Coffe 812,183
Telegraphic signals, receiving, S. D. Field .. 812,557
Telephone switch plug mechanism, A. C. Gilgen 812,401
Telephonic repeating system, A. J. P. Bertschy 812,718
Telescope, rifle, F. L. Smith 812,376
Test clamp, T. Nagel 812,287
Thermal protector and alarm, F. B. Cook .. 812,184
Thermometer, clinical, W. F. Fruehauf, 812,550, 812,500
Threshing machine, W. Brenton 812,719
Tilting bin and cover, W. C. Horner 812,343
Tire for automobiles, wheel, Kerngood & Taylor 812,427
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Tire protector, pneumatic, L. L. Sidwell ... 812,373
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Traction wheel, F. H. Knight 812,502
Transferring apparatus, A. M. Cathey 812,636
Transplanter, W. Fetzer 812,556
Trap, J. E. Pittman 812,522
Tripod head, M. C. Rock 812,233
Trousers press, J. L. Hattery 812,742
Truck bolster, cast, R. C. Washburn 812,318
Tube, conduit, and pipe cleaner, Pickles & Sewell 812,361
Tubes, helically grooving, R. C. Monteagle. 812,435
Tubes, machine for helically grooving, R. C. Monteagle 812,434
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Turbine gate mechanism, N. Lombard 812,506
Turbine, steam, N. R. Smith 812,093
Turpentine gathering spout, J. I. Hatfield. 812,692
Typewriting machine, E. J. Barker 812,177
Typewriting machine, B. A. Brooks 812,782
Typewriting machine back-spacing attachment, G. A. Rine 812,080
Typographic machine, C. Muehleisen 812,585
Union coupling, H. S. Crombie 812,042
Unloading mechanism, G. Ward 812,623
Vacuum brake, automatic, J. W. Cloud 812,481
Valve, air, W. J. Rice 812,451
Valve bag, J. Rogers 812,454, 812,455
Valve, float, W. Gray 812,337
Valve for air brakes, distributing, G. Knorr 812,732
Valve for gas generators, R. Schenck 812,083
Valve for gas or oil burners, cut-off, A. Ashcraft 812,715
Valve, hydraulic distributing, W. H. Wood. 812,629
Vegetable strips, manufacture of, E. Stoffel 812,403
Vehicle, motor driven, H. T. Hansen 812,338
Vehicle seat, auxiliary, T. W. Parks 812,300
Vehicle transmission gear, motor, T. P. Meinhard 812,604
Vehicle, two-wheeled, F. M. Harrington 812,421
Vehicle wheel, M. G. Heitz-Boyer 812,562
Vehicle wheel, M. G. Baisle 812,629
Vending machine, automatic, A. B. Wyatt. 812,778

Vessel, marine, J. J. Sitzler 812,604
Wagon brake, J. Happel 812,339
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Wagon, dumping, M. Harles 812,739
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Washing machine, S. K. Rice 812,772
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Water closet bowls, floor flange for, A. Buchanan, Jr. 812,543
Water control system, A. J. Collar 812,482
Water level gaging instrument, R. E. Horton 812,209
Weaner, cow, calf, and colt, W. T. Horne 812,342
Weed cutter, J. Killefer 812,276
Weed exterminator, H. Thoeni 812,616
Well device, oil, H. Wilson 812,711
Well drilling machine, D. L. Baugher 812,393
Wells, device for recovering articles from deep, E. A. Stubler 812,379
Wheel. See Locomotive wheel.
Wheel, C. A. Brinley 812,179
Wheel cutting machine, worm, W. B. McLean 812,441
Wheel rim, rubber tired, O. L. Pickard, reissue 12,450
Whiffletree connection, O. C. Dickerman 812,188
Whiffletree hook, G. W. Wilson 812,390
Windmill regulating mechanism, M. S. Newcomer 812,671
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Window screen, C. C. Hirsch 812,654
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Wire rope protector, Downs & Wally 812,413
Wire stretching device, W. Broad 812,401
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Woodworking machine, O. C. Wysong 812,317
Wrench, I. Weisnek 812,538
Wrench, N. Delisle 812,551

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Bracelet, J. Bennett 37,818
Cutter lever handle, H. K. Porter 37,826
Glass dish, J. M. McMahon 37,821
Illuminator, O. A. Mygatt 37,824, 37,825
Rug, F. A. Haas 37,828
Sign, illuminated chandelier, J. L. Dawes 37,823
Stamp, premium, J. A. Johntra 37,822
Toilet powder receptacle, W. A. Bradley 37,819

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Antiseptic and detergent washes, Hy-Jen Chemical Co. 49,566
Antiseptic liquid, Hudson & Co. 49,565
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Beer, lager, Zeltner Brewing Co. 49,754
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Blacking, liquid, C. L. Hauthaway & Sons 49,631
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Boots and shoes, leather, Thomas G. Plant Co. 49,788
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Boots, shoes, and slippers, leather, Fred F. Field Co. 49,767
Bracelets, F. H. Sadler Co. 49,779
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Bromids, preparation of, Peacock Chemical Co. 49,572
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Buttons, collar, Krementz & Co. 49,770
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Canned fruits and vegetables, M. J. Boyer 49,629
Canned fruits and vegetables, Frank C. Weber & Co. 49,650, 49,651
Canned fruits and vegetables, Portland Packing Co. .... 49,670 to 49,673
Canvas hose duck, awning stripes, and sail duck, Mount Vernon-Woodberry Cotton Duck Co. 49,722
Cards, playing, New York Consolidated Card Co. 49,742
Cards, playing, United States Playing Card Co. .... 49,745 to 49,748
Cartridges, Union Metallic Cartridge Co. 49,615
Cartridges and cartridge shells, Union Metallic Cartridge Co. .... 49,606, 49,607, 49,610, 49,614, 49,620 to 49,624
Cartridges and metal and paper cartridge shells, Union Metallic Cartridge Co. 49,611
Cartridges and parts thereof, gun and pistol, Union Metallic Cartridge Co., 49,612, 49,613, 49,616 to 49,619
Cement, channel, C. L. Hauthaway & Sons 49,633
Cement, leather, C. L. Hauthaway & Sons 49,632
Champagne, Ginter Grocery Co. 49,737
Chocolate and cocoa, Knickerbocker Chocolate Co. 49,714
Chocolate creams, C. Gousset 49,709
Cigars, Sanchez & Haya Co. 49,728
Cigars and cheroots, D. H. Levy 49,662
Cleansing or scouring compound, S. Lichtenstein Co. 49,677
Cleansing or scouring compound, Enoch Morgan's Sons Co. 49,646
Clocks, Ansonia Clock Co. 49,731, 49,732
Coffee, G. J. Keller 49,660
Coffee, Porto Rico Co. 49,674
Coffee preparation, Pfeiffer & Diller 49,668
Combs, Schrader & Ehlers 49,574
Cordials, W. F. Mitchell 49,721
Corsets, Birdsey & Somers 49,702, 49,703
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Cotton duck, Mount Vernon-Woodberry Cotton Duck Co. 49,774
Cotton piece goods, Massachusetts Cotton Mills .... 49,718 to 49,720
Cotton piece goods, Tremont & Suffolk Mills 49,750
Cotton piece goods, Massachusetts Cotton Mills 49,773
Fasteners, Patent Button Co. 49,740
Feed consisting of ground corn and oats, cattle, Dock & Coal Co. 49,640
Files, Carver File Co. 49,706
Files and rasps, Nicholson File Co. 49,686
Foods for invalids and infants, Sunbrights California Food Co. 49,685
Forges, Champion Blower and Forge Co. 49,690
Gas mantles, self-lighting incandescent, Usona Light Co. 49,751
Glass electric globes and glass shades, Phoenix Glass Co. 49,741
Gloves, Abraham & Straus 49,701
Gun grease, Winchester Repeating Arms Co. 49,699
Hammers, A. R. Robertson 49,590
Hats and caps, M. Sonneborn 49,730
Hats and caps, Knox Hat Manufacturing Co. 49,783, 49,784
Hooks and eyes, Star Pin Co. 49,744
Hooks and eyes, Unique Manufacturing Co. 49,786, 49,787
Hypophosphites, preparation of, Fellows Medical Manufacturing Co. 49,578
Knit underwear, Direct Supply Co. 49,734, 49,735
Knitted underwear, Glastonbury Knitting Co. 49,768
Lamp chimneys and lamp globes, L. H. Peltason 49,723
Lamps and lanterns, railway, Armspear Manufacturing Co. 49,757, 49,758
Lard and lard compound, N. K. Fairbank Co. 49,694
Lathes, National-Acme Manufacturing Co. 49,597
Lathes, metal turning, Lodge & Shipley Machine Tool Co. 49,595
Lead, white, National Lead Co. 49,665
Leather, Joseph N. Eisendrath Co. 49,738, 49,739

Leather polish, Whittemore Bros. & Co.	49,698
Lightning rods, Dodd & Struthers	49,586
Liniment, World's Dispensary Medical Association	49,582
Lubricants and lubricant stock, cylinder, Conewango Refining Co.	49,692
Lubricating grease, A. C. Busby	49,630
Lubricating grease, A. Cook's Sons	49,636
Medical compound, S. H. E. Hayden	49,564
Medicine for certain named diseases, Buker Pill Co.	49,577
Medicine for internal use, Potter Drug and Chemical Corporation	49,724
Medicine for women's diseases, proprietary, W. A. Talbott	49,575
Metal polish, Cosseboom, Pearce & Co.	49,635
Mineral water, Berry Hill Mineral Spring Co. of Virginia	49,733
Mineral waters, M. A. Ferris	49,649
Nails, horse, Standard Horse Nail Co., 49,591, 49,592, 49,681 to	49,683
Nails, wire, C. F. Baker & Co.	49,583
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Oiled clothing, A. J. Tower Co.	49,700
Oiled clothing of all kinds, A. J. Tower Co.	49,756
Ointment, Potter Drug and Chemical Corporation	49,573
Ointments, cream, National Toilet Co.	49,589
Olives and pickled olives, Los Angeles Olive Growers' Ass'n	49,663
Packing for valve joints, Fairbanks Co.	49,780
Paint, mineral, Chattanooga Paint Co.	49,634
Paints and insulating compounds, Standard Paint Co.	49,696
Paste, Perservaline Manufacturing Co.	49,785
Pens, fountain, L. E. Waterman Co.	49,715
Pens, steel, Perry & Co.	49,776
Pianos, E. E. Gabler	49,652
Pills, Allcock Manufacturing Co.	49,559
Pills, sugar coated, Lanman & Kemp	49,570
Pins, toilet, Star Pin Co.	49,609
Plows, cultivators, rollers, and harrows, Wiard Plow Co.	49,608
Polish, certain named, Crosby & Co.	49,639
Powder, toilet, Byron C. Gould 49,560,	49,584
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Purgative compounds, liquid, California Fig Syrup Co.	49,561
Refrigerators, D. Eddy & Sons Co.	49,707
Remedy, external, C. T. Mackenzie	49,571
Remedy for certain named diseases, Cushman Drug Co.	49,562
Remedy for certain named diseases, Porter Medicine Co.	49,579
Remedy for certain named diseases, T. P. Van Ness	49,580
Rifles, shotguns, and revolvers, H. Keidel	49,713
Rock crushers, Samson Manufacturing Co.	49,598
Rugs, Read Carpet Co.	49,743
Rusks, Holland Rusk Co.	49,656
Saw swages, Henry Disston & Sons	49,711
Saws, Henry Disston & Sons	49,654
Saws and hacksaw blades, hack, G. W. Griffin & Co.	49,710
Seals, E. J. Brooks & Co.	49,645
Seed, grass, H. E. Conklin	49,789
Seeding machines, Monitor Drill Co.	49,596
Sewing machine stands and their parts and attachments, Singer Manufacturing Co.	49,601
Sewing machines, Singer Manufacturing Co., 49,599, 49,600, 49,602 to	49,605
Sharpening stones, Pike Manufacturing Co., 49,669,	49,695
Shirts, collars, and cuffs, dress, Bloch & Neuburger	49,760
Shirts, dress, Richardson, Roberts Dry Goods Co.	49,726
Shirts, dress, bosom, and negligee, Howe & Howe	49,712
Shovels, spades, and scoops, Supplee Hardware Co.	49,593
Silver plated hollow ware, International Silver Co.	49,769
Skins, tanned sheep, Richard Young Co.	49,725
Soap, Hoffheimer Soap Co.	49,655
Soap, Charles N. Crittenton Co.	49,687
Soap, laundry, A. Conkling	49,638
Soap, medicated and perfumed, Potter Drug and Chemical Corporation	49,675
Soap, scouring, Bon Ami Co.	49,628
Soap, sulphur, Aschenbach & Miller	49,627
Soap, toilet and both, A. Conkling	49,637
Soap, toilet and laundry, Haskins Bros. & Co.	49,653
Soda, cream of tartar, and baking powder, baking, E. R. Durkee & Co. 49,641 to	49,644
Spices, prepared, Jaburg Bros.	49,657
Starch and dextrin, Norddeutsche Kartoffelmehl Fabrik mit beschrankter Haftung	49,667
Starch, laundry, Celluloid Starch Co. 49,688,	49,689
Stockings, Columbia Hosiery Co.	49,763
Stogies and tobies, S. Ewart & Co.	49,648
Stogies or tobies, S. Ewart & Co.	49,647
Stoves, ranges, furnaces, heaters, and parts thereof, Magee Furnace Co.	49,717
Tack and nail pullers, General Specialty Co.	49,594
Toilet cream, J. M. Grosvenor & Co.	49,563
Tonics, S. Iseman	49,568
Tonics, F. A. Luyties	49,588
Tooth powder, American Peroxide and Chemical Co.	49,576
Trucks or low wheel wagons, farm, Deere & Webber Co.	49,585
Turpentine, Ball Chemical Co.	49,686
Twyers, Champion Blower and Forge Co.	49,691
Valves for fluids, regulating, T. P. Ford	49,708
Vinegar, Siegel, Cooper & Co.	49,679
Washing machines, Spotless Co.	49,680
Whisky, L. J. Adler & Co.	49,626
Whisky, Kaufmann Bros. & Co.	49,659
Whisky, M. Lange	49,661
Whisky, Schuckmann & Seligmann Co.	49,678
Whisky, Straus, Gunst & Co.	49,684
Whisky, A. Loeb	49,716
Whisky, Schuckmann & Seligmann Co.	49,729
Whisky, Bigbie Bros. & Co.	49,759
Whisky, Lazarus & Nassauer	49,771
Whisky, L. Nelson	49,775
Whisky, Donoghue Importing Co.	49,778
Whisky, Hoffheimer Bros. Co.	49,782
Wine, California Wine Association 49,704,	49,705
Wine, Wm. Hoelscher & Co.	49,753
Wooden receptacles, certain named, Prewitt-Spurr Manufacturing Co.	49,777
Worm syrup, Dr. C. A. Voorhees Estate	49,581
Wrenches, Whitman & Barnes Manufacturing Co.	49,625

LABELS.

"Au Marchand Chinois," for linen thread, Societe Anonyme Filature and Filteries Reunies	12,667
"Blue Ribon," for baking powder, Wabash Chemical and Baking Powder Co.	12,657
"Fil Gire, Noir Sublime," for linen thread, Societe Anme. Filature and Filteries Reunies	12,666
"Glycero-Medicated-Plaster," for medicated plasters, Physicians Chemical and Drug Co.	12,663
"Hills Di-Col-Q.," for medicine, Indiana Drug Concern	12,661
"Hills Honey and Tar," for medicine, Indiana Drug Concern	12,660
"La Chapina," for flour, I. Rich	12,658
"Pillole Antimalariche Liver Pills," for liver pills, R. Giovanni	12,662
"Rest—A High Grade Washing Powder," for washing powder, Soap Products Co.	12,664
"Speed—Pulverized Scouring Soap," for scouring soap, Soap Products Co.	12,665
"The Harvard Eye Remedy," for eye medicine, G. S. Rubin	12,650

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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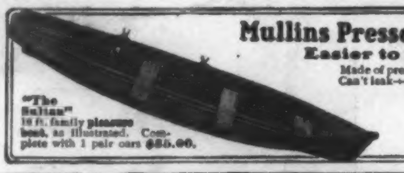

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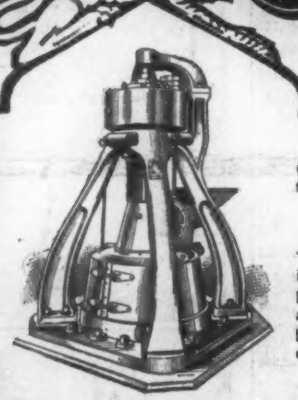

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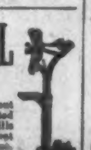

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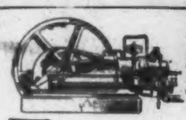

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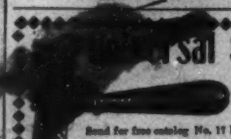

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